TreeCents©

Timber Investment Analyzer

Inland West Edition 2.11

Easy to Use Reference Manual

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Inland West Edition 2.11
Timber Investment Analyzer
Easy-to-Use Reference Manual
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1.0 WELCOME TO *Tree¢ents*

Private forest owners often make large timber investment decisions about valuable forest assets on faith--without taking time for financial analyses. Its easy to see why. Timber investment analyses are complicated. Even astute consulting foresters often make large efforts to measure physical, biological, and ecological implications of forest management prescriptions, while avoiding the pain of financial analyses.

Martin Faustmann developed soil expectation valuation for timber investments in 1849, but famous economists still make errors applying his formula. Timber cash flows are irregular, sometimes conditional and always difficult to predict. Evaluation formulas are complex, arcane, and they are difficult to compute, much less understand. Hand calculations take hours. Miscalculations are easy and frequent. The few computer programs that do make timber investment calculations can be limited, laborious or unfriendly. But you can't make profitable decisions about highly variable timber investments by ignoring the main economic influences on their financial returns.

1.1 What TreeCents does for you

TreeCents changes all that. It makes sophisticated financial analyses easily available to private forest owners and the agency and consulting foresters who work with them. You don't have to be a forest economist or an MBA. Forest owners can do this at home or in the field.

TreeCents is a user-friendly analysis assist template that organizes the necessary data for four different land use investments including: new timber plantations, existing timber stands (whether even or uneven-aged), agricultural crops and grazing. It is an MS-EXCEL™ -based program so it runs on most modern personal computers in both older and updated Microsoft operating systems.

TreeCents isn't just another pretty little program. TreeCents is powerful, yet easy to learn. It guides you through data needs, hides the math and spits out results automatically. It calculates four standard business decision criteria to make investment choices easier for you and credible for your investors. TreeCents is quick and cheap to use over and over so you can test variants of project designs to search for even higher returns. TreeCents can even help you second guess your assumptions and increase confidence in what used to be risky, poorly quantified guesses about long-run timber futures.

TreeCents does this by combining logical and mathematical templates to identify and organize cash flows for a wide variety of timber investments. Forest owners button navigate to appropriate analyses for their projects. Data formats help users identify and include all the relevant factors that affect timber project feasibility. Warning flags signal critical data assumptions and help is available on each screen. Embedded formulas automatically compute investment evaluation criteria and display them in standard comparison reports so that users can make immediate project choices and comparisons. These criteria are in standard absolute and relative financial feasibility measures. TreeCents even considers each individual's unique tax environment.

TreeCents users can second-guess investment choices with built in pessimistic and optimistic project outcome brackets, or measure the sensitivity of financial assumptions and forecasts by saving scenarios and reevaluating them as assumptions vary.

To help land owners compare timber to non-timber land investments, TreeCents can also evaluate alternative land use returns. The program runs four main analysis types separately or simultaneously: (1) new timber plantations either as afforestation or reforestation; (2) existing timber stands, whether they are established plantations, even-aged forests, or uneven-aged (selection) forests; (3) agricultural crop alternatives such as cultivated row crops in user defined 3-year rotation cycles; and (4) annual pasture use. Both of the latter uses can be compared directly with timber investment returns on a per acre basis. We make non-timber analyses available for gross land use comparisons only. The modules are generalized and don't include details found in agricultural software.

1.2 Its still your timber investment decision

We've taken great care in designing a friendly reliable analytical program. This latest upgrade of TreeCents has been debugged repeatedly and field tested. However, long-term timber investments are inherently variable and risky so assuring the financial feasibility of projects is still a land owner's burden. We have no control over project design, or data selection, representation and quality. Most peoples' expectations of future ecological, managerial, and market conditions are notoriously inaccurate. There are places where TreeCents calculations for typical land investments may not exactly fit yours, particularly in imbedded assumptions about owner profiles and financial behavior in forecasting and taxes. And finally, although we have provided guides for using TreeCents financial criteria, it is remains the land owner's responsibility to identify and choose profitable projects.

2.0 INSTALL TreeCents

TreeCents installs quickly from this CD. It will run immediately on most computers with WINDOWS™ operating systems. Some may need a few system adjustments.

2.1 System Requirements

TreeCents is designed for IBM or clone personal computers with a resident MS-WINDOWS™ 95 (or later) operating system. A CD reader is required. TreeCents is an EXCEL-based program with VISUAL BASIC commands, so EXCEL 97 (or later) must be preinstalled. TreeCents is getting larger with every upgrade. Older Pentium III 266 Mhz processor and 64 Megabytes of RAM will still run TreeCents, but expect slow program loading and hesitant operations. Faster processors and more memory significantly improve loading and calculation speed. Loading takes about 20 seconds on my 2 Ghz machine, but operations are almost instantaneous.

2.2 Installing the TreeCents Manual

You're already reading the manual, so you must have seen this part in the CD **readme** file. The TreeCents manual is in Adobe (.pdf) format to make it easy to read and hard to change. You must have Adobe Acrobat™ Reader to read .pdf formats. Acrobat

reader is a free download from the Adobe company home page www.adobe.com. When we run TreeCents, we usually load the manual first into its own background window so we can toggle in and out of it while we're working in TreeCents.

2.3 Installing the TreeCents Program

To install TreeCents, place the TreeCents CD in your CD reader. It's the pop-open shelf that you thought was a cup holder. Most personal computers read the CD drive contents as soon as a CD is inserted. TreeCents can be run directly from our CD, but you should **copy the TreeCents file directory onto the computer hard drive**. This increases operating efficiency and allows you to save project data files.

We suggest that you copy the whole TreeCents directory file from the CD into the "my documents" file on your computer. The TreeCents directory contains two subdirectories. One is the EXCEL program file and one is another subdirectory designed to store your initial default data files. It is also a good place to store your future project files.

You may need to change some WINDOWS settings. First, your computer's EXCEL security settings must be compatible. New MS-OFFICE™ installations are usually set with **high** security defaults to minimize virus problems. To run TreeCents and most other template programs, you must reset the security level. In EXCEL, select the **Tools** menu. Under **Options**, select **Security** and then **Macro Security**. Reset Macro Security to **medium**. This allows EXCEL to read and process the TreeCents programming macros. Medium security level is sufficient to detect and resist most system viruses. TreeCents production computers are virus protected and we used the latest Norton Antivirus™ version to double check that TreeCents distribution disks are virus free.

Most WINDOWS screen resolution defaults are compatible with TreeCents programming. Your TreeCents CD is designed for a small monitor because we expect that most users will also want to run TreeCents on their laptops as well as on their desktop personal computers.

If the TreeCents windows aren't well matched to your display, there are two solutions. You can reset your whole display resolution. Go to **Control Panel**, select **Display**, select **Settings**. Move the screen pixel indicator to your desired resolution. You can also scale the screen resolution using the EXCEL **Zoom** feature under the **View** menu.

Finally, using the **Full Screen** option under the EXCEL **View** menu really makes TreeCents windows large, clear and bright. Make sure that program icons still appear in your start toolbar to allow multi-tasking. Being able to toggle back and forth to the manual and to other data sets really increases your analytical efficiency.

3.0 RUNNING TreeCents

Once TreeCents is loaded, it is easy to run. Click open Microsoft EXCEL™. Close any other EXEL files that you may have been working on because running TreeCents may close those files without asking you. Not to worry, they will be saved as you left them.

Click **Open** on the **File** menu. Find the file **TreeCents.xls** in the subdirectory under the one you copied the CD directory to. It will usually be in a C-disk directory such as **C:\My Documents\TreeCents**. Double-click on the TreeCents program to open it.

The first thing you'll see is EXCEL's macro warning and query. TreeCents uses VISUAL BASIC programming macros. In the query box you must **Enable Macros** in order to proceed. When TreeCents opens, the initialization window (figure 1) should be on your screen. If the TreeCents file fails to open, there is a >90% probability that you forgot to reset your EXCEL security from high to medium.

Data in TreeCents can easily be changed and saved, but not to worry, the program itself is protected so that it is extremely difficult to change or damage it. If you do somehow corrupt the files, the original from your CD can be reloaded. If you find a continual fatal error in any of the program functions, please report it back to the TreeCents programmers.

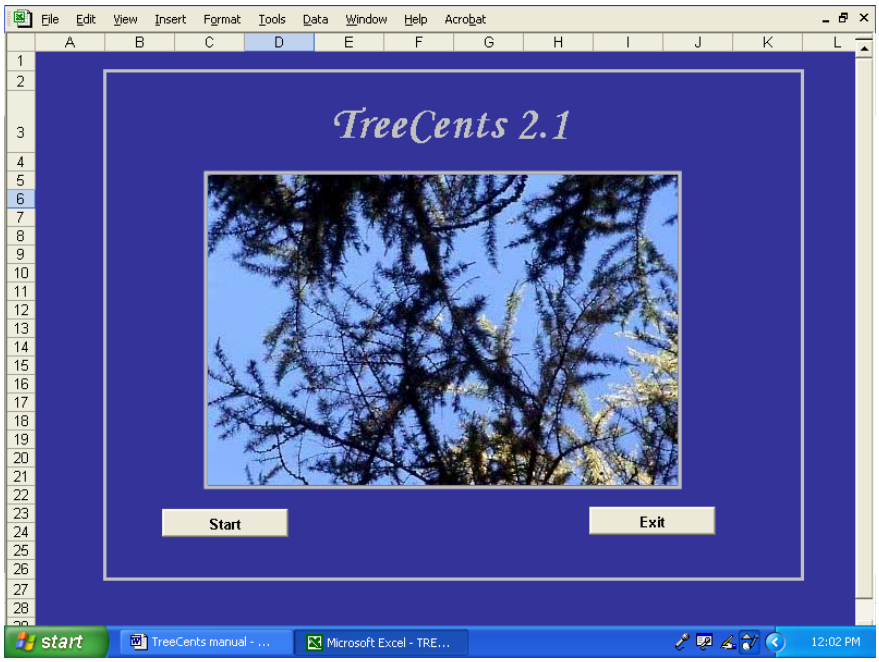

Figure 1: TreeCents initialization window

Pressing **START** transfers you to the program introduction window (Figure 2). Whenever you press the **EXIT** , you have a choice to exit without saving this session or exit saving the last data set used as a project data set.

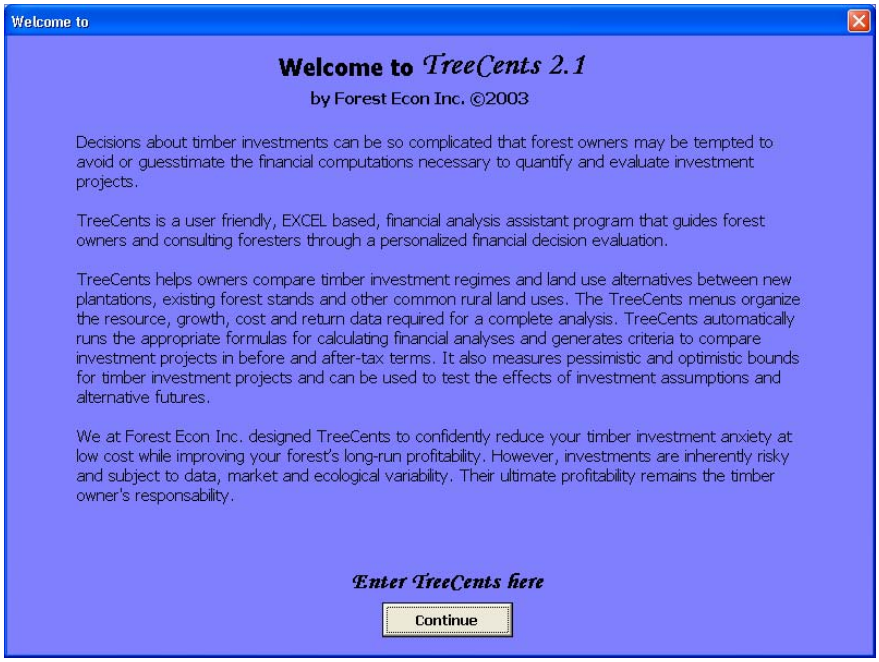
Welcome to
Welcome to TreeCents 2.1
by Forest Econ Inc. ©2003
Decisions about timber investments can be so complicated that forest owners may be tempted to avoid or guesstimate the financial computations necessary to quantify and evaluate investment projects.
TreeCents is a user friendly, EXCEL based, financial analysis assistant program that guides forest owners and consulting foresters through a personalized financial decision evaluation.
TreeCents helps owners compare timber investment regimes and land use alternatives between new plantations, existing forest stands and other common rural land uses. The TreeCents menus organize the resource, growth, cost and return data required for a complete analysis. TreeCents automatically runs the appropriate formulas for calculating financial analyses and generates criteria to compare investment projects in before and after-tax terms. It also measures pessimistic and optimistic bounds for timber investment projects and can be used to test the effects of investment assumptions and alternative futures.
We at Forest Econ Inc. designed TreeCents to confidently reduce your timber investment anxiety at low cost while improving your forest's long-run profitability. However, investments are inherently risky and subject to data, market and ecological variability. Their ultimate profitability remains the timber owner's responsability.
Enter TreeCents here
Continue

Figure 2: Introduction window

Read the introduction window at least the first time. It tells you what we think TreeCents can do for you. It also reinforces our belief that TreeCents only organizes and automates the tedious mechanical parts of timber financial analyses. The really critical thinking parts of timber investment decisions still rely on you. Feasible timber projects depend on your own perception of the variables that affect creative timber project decisions, and your own personal evaluation of decision criteria. Now press **CONTINUE** .

Pressing any WINDOWS™ close symbol in the upper right of the window takes you directly back to the start window. It will save your last entries until you overwrite them or close TreeCents without saving.

3.1 Choosing an analytical path

TreeCents project specifications and calculations are designed as a series of branching paths to keep users from getting lost among 150+ program windows. Use buttons to choose path branches and move forward fork by fork along the preferred branch. If you go too far or want to revisit something behind you, you can button **Back** or **Cancel** in the reverse direction window-by-window. To rapidly revisit often-used path nodes, we have jump back buttons in two places. The ones located in the cost entry windows send you back to the cost entry menu to speed up sequential entries into different management cost categories. The other type is located in each of the project financial criteria reports. They loop you back quickly from final report windows to the appropriate project start window. This allows you to rapidly respecify a project after looking at a set of results.

The process initialization window (figure 3) takes you to either a project definition process or a project comparison process. New manual readers will want to define new individual projects with **Start a New Analysis** . Experienced users with many existing finished projects to rank may want to **Compare Results** at a later session.

This manual serves primarily as a training device, so we organized it to first introduce several types of timber projects and follow default example cases. New users should read and follow timber project sections in order. Other analytical routines such as non-timber land use projects and multiple project routines are covered later.

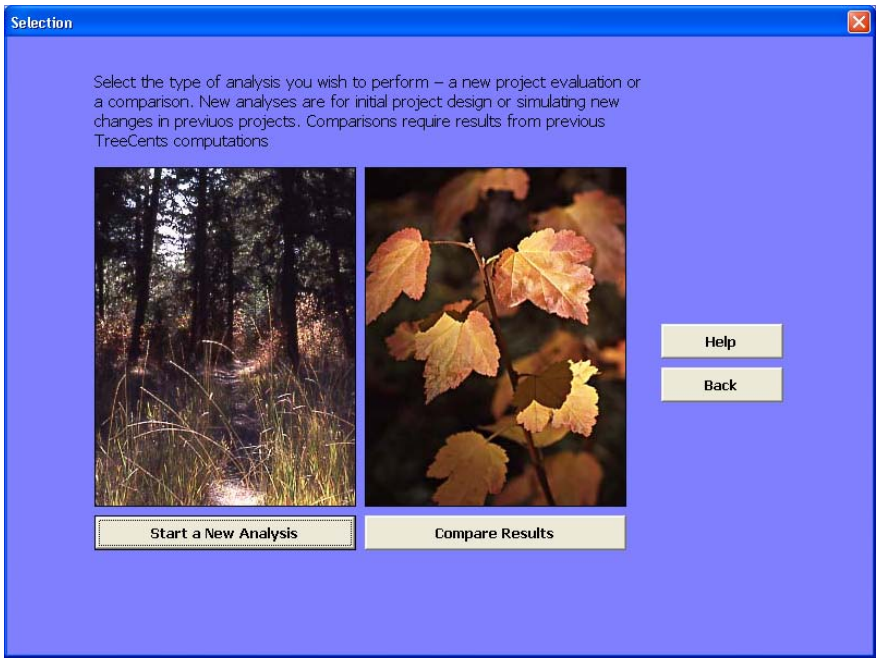
Selection
Select the type of analysis you wish to perform – a new project evaluation or a comparison. New analyses are for initial project design or simulating new changes in previuos projects. Comparisons require results from previous TreeCents computations
Help
Back
Start a New Analysis
Compare Results

Figure 3: Process initialization Window

The project type choice window (figure 4) lets you choose between two types of land use projects. **Timber Uses** opens 2 timber templates for new plantations and existing timber stands. **Alternative Land Use** opens agricultural crop and pasture templates.

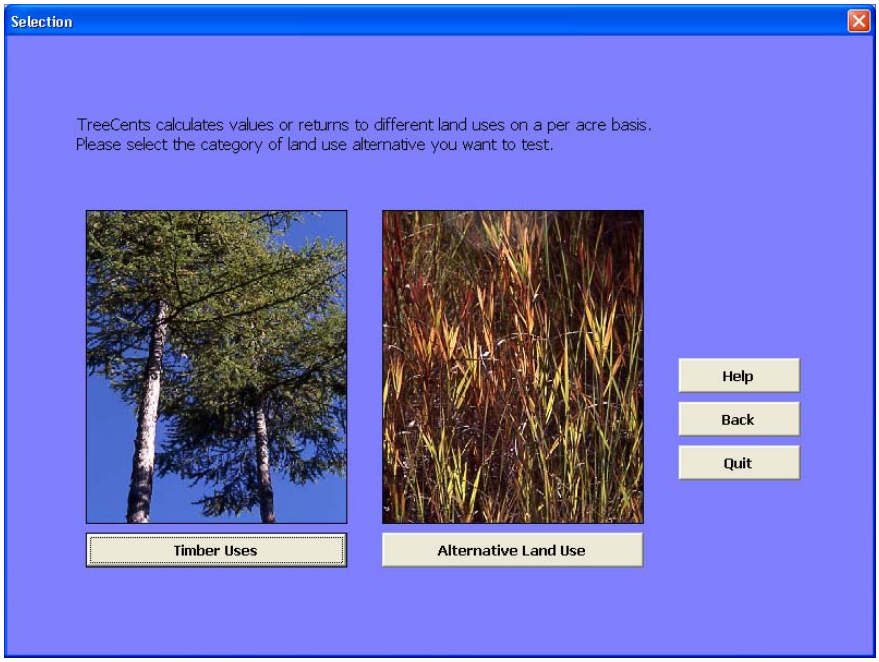
Selection
TreeCents calculates values or returns to different land uses on a per acre basis.
Please select the category of land use alternative you want to test.
Help
Back
Quit
Timber Uses
Alternative Land Use

Figure 4: Project type choice window

3.2. Choosing timber options

TreeCents has two timber investment options on the timber project type window (figure 5): **Establish New Timber Plantation** and **Evaluate Existing Forest or Established Plantation** . The left-hand option evaluates new plantations—future timber stands starting from bare land initial conditions that are typically managed under even-age silvicultural regimes. This analysis path will handle both: (1) afforestation that puts trees into previously nonforested sites, and (2) reforestation that replants previously forested sites that have been recently clearcut.

The right-hand option evaluates existing forests—i.e. timber stands that currently have two components including both land and an established timber stand of any age or structure. Existing forest types include well-established plantations, or other timber stands that have been managed by either even-age or uneven-age (selection) silviculture. The presence of an **alarm bell** warns of an extremely important input. Click on it for immediate warnings or important explanations.

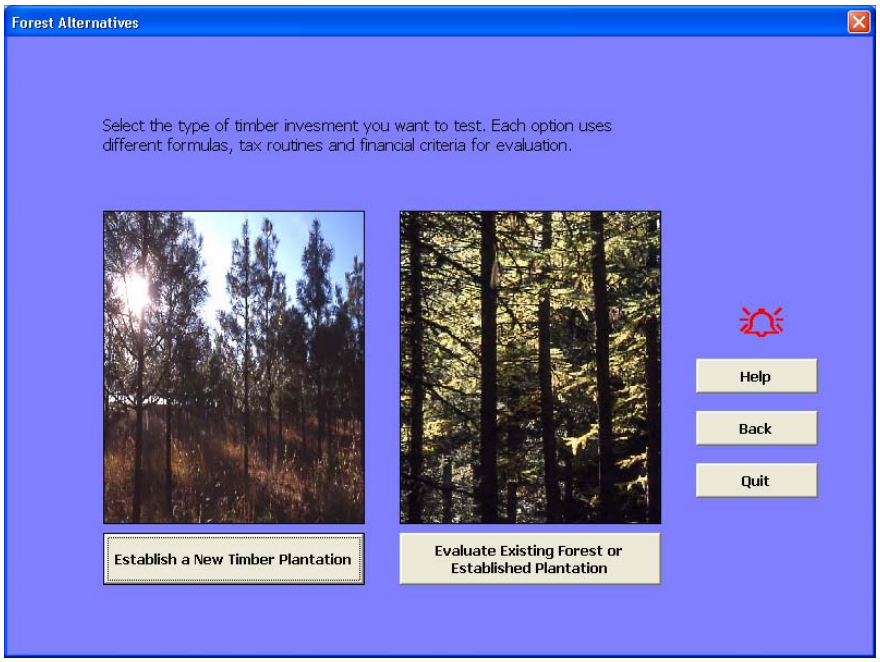
Forest Alternatives
Select the type of timber invesment you want to test. Each option uses different formulas, tax routines and financial criteria for evaluation.
Help
Back
Quit
Establish a New Timber Plantation
Evaluate Existing Forest or Established Plantation

Figure 5: Timber project type window

The timber project options are separated for three reasons. First, bare land and existing forests have different starting asset values. When this is the case, it is not logical

to compare their evaluation criteria results directly. First, analysts must normalizing these criteria to make them comparable. Second, plantations are easily standardized into fixed even-age harvest and regeneration cycles, while established forests, particularly natural ones under uneven-age management, may have irregular and non-uniform harvest entries over the long-run. Finally, federal income taxes (and some state taxes) treat the two categories differently. Plantation establishment costs are amortized and intermediate costs are either expensed or capitalized. Existing forests have original cost basis computations.

To facilitate self-instruction, we wrote this manual to demonstrate new plantation analysis instructions and explanations in great detail in the following section. As there are numerous similarities between new and existing forest analyses, we describe only the differences for existing forest analysis in the later sections.

User Tip

Use TreeCents' default cases to familiarize yourself with data requirements and output files. The default data is from actual project examples. However, do not make inferences from default case results. Write your own project specs over the default data to generate tailored results for your own investments.

3.3. Formulating new timber plantation projects

First choose **Timber Uses** on the project type choice window (figure 4). Then select **Establish a New Timber Plantation** on the subsequent timber project type window (figure 5). On the next window, TreeCents can either define new projects with **Use New Data Set ,** or revisit, adjust and reevaluate earlier analyses with **Use Existing Data Set** . For training, make your first choice **Use New Data Set**. You will be able to see the default data entry examples and then just over-write them with new project specifications that represent your own project. Save your own data later.

3.3.1 TreeCents data sets

If you are just starting to use TreeCents, you will need to build up a new data set. Data sets are the organized collection of all the information that TreeCents will need to financially evaluate your timber investment. TreeCents supplies the data organization for you. TreeCents data templates query a user for the different types of data usually needed. It uses forestry information terms, categories, logic and measures that are common in forest

management. Behind the scenes, TreeCents reorganizes all the data into formats needed for financial analysis.

TreeCents data sets are saved in a unique EXCEL format necessary for the program to reread each entry accurately. However, each data set is organized so that you can read and interpret them directly in EXCEL without TreeCents. TreeCents data sets are designed to be printed out as permanent planning records.

3.3.1.1 New data sets

As a new TreeCents user, you'll choose **Use New Data Set .** This takes you to the timber plantation data organization window. The timber investment project data requirements are discussed beginning in section 3.3.2, but first consider what a data set is doing for you.

Your new data set collects, organizes and stores project data for you. Of course, that helps you set up the initial analysis of this particular project, but just as important, it makes subsequent projects quicker and easier to design. Over 50% of TreeCents timber data will be common to all timber projects, so why reenter? Just call up a previous project and write over the entries that are different. In practice, many analyses are just minor adjustments of a previous project regime. In these cases, over 95% of previously entered project data will be reused. So take a little time to organize, label and save project data sets. It will save you lots of time later. We'll show you how to save TreeCents data sets at the end of section 3.

3.3.1.2 Existing data sets

If you already have your own TreeCents data sets, you'll choose **Use Existing Data Set** . If you are calling up an existing data set, it must be in TreeCents format from a previous run and be in a subdirectory that is accessible from EXCEL. TreeCents data sets have a different extension, so specify all file types when you search for them.

When using an existing data set, an intermediate window first warns you to be ready to specify an existing TreeCents data set. You can back out at this stage by pressing **Cancel .** However, once you continue into the EXCEL file list (figure 6), you must specify a TreeCents data set for use.

Pressing **Cancel** within the EXCEL window will cause an EXCEL error message. You can get out, by pressing **End** , but EXCEL will send you back to "GO" (the TreeCents initialization window) and don't collect $200. If a data file you called comes into TreeCents as computer gibberish, you've pulled up a wrong file that was not previously saved from TreeCents in the correct format.

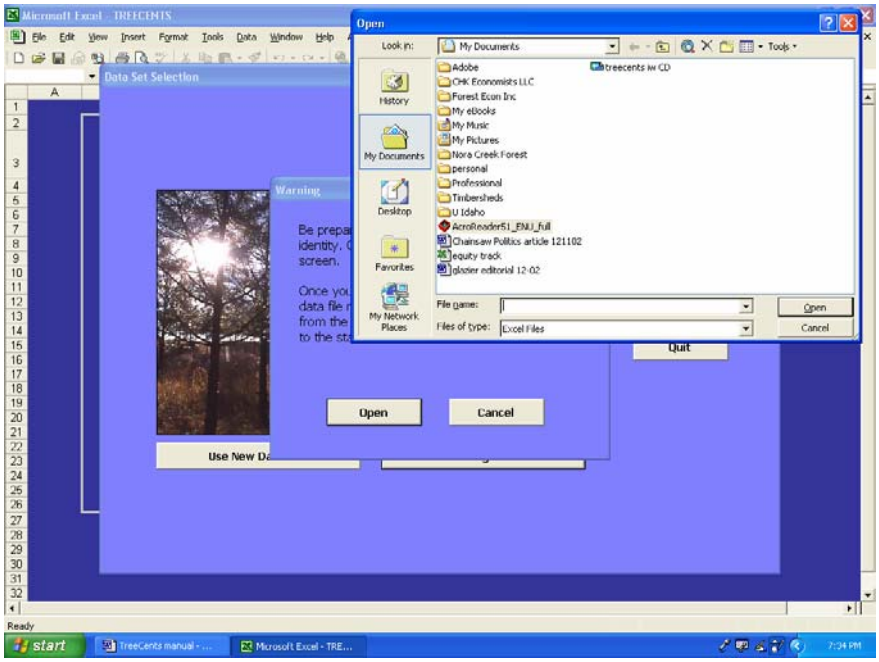

Figure 6: Existing data set callup window

3.4 Designing your timber investment regime

Timber investment projects, even plantations, can be extremely variable and take lots of data of many different types. Typically, timber projects are front-end-loaded. That means that you start the process by allocating forest assets (such as land and existing timber) to a project and doing something to them. These early allocations and expenses typically start a forest growth response that affects future harvest volumes, values and project returns. Growth trajectories are often redirected midstream by intermediate practices that have both real time costs and long run effects. As a forest owner, you should already have a good preconception of a timber project profile and be able to quantify the various elements as TreeCents entries.

There are two scale considerations: project size and analytical resolution. TreeCents makes all variable size projects comparable on the same scale by **working in per acre terms**. If your project has multiple acres as most do, put in representative per acre averages. There may be some large project level costs and revenues that have to be apportioned down to a per acre equivalent. You can then expand results back up to project scale at the end by simply multiplying your results by the real number of acres. This seems like an unnecessary step, but it eliminates your risk of fallaciously comparing big and small scale projects.

Analytical resolution is your choice. Back in the days that people calculated all this long hand, optimal resolution was low—i.e. they didn't include many factors that affect the estimated investment outcome. Typically, forest owners guessed whether a project was profitable or at most compared the planting costs to one discounted potential gross harvest without considering taxes. Calculators allowed more detail and intermediate cash flow effects, but still owners missed the subtleties of conditional interactions, particularly where taxes are concerned. Now, TreeCents enables you to include almost any detail and calculate the effects. This is a tremendous feature, but it also requires lots of data. Realistically, you don't have to use TreeCents full capability. Sometimes small items have small effects—sometimes the precision of what you know about the future isn't worth the effort to include more. Find the resolution level of analysis that best fits your own needs.

3.5 Timber data needs

Timber projects evaluations are based on lots of different types of information. There is background project information such as: identification and initialization entries; product and market conditions; individual personal financial differences. There are project initialization activities such as: site prep and planting. You will have intermediate practices such as pruning and thinning. Finally, you will have outcomes, particularly volumes and values of timber harvests spread over the project life. TreeCents data organization helps you make orderly sense of all this information.

3.5.1 Timber data organization window

The timber plantation data organization window (figure 7) is really a menu. It is designed as a starting place to help you organize the types of financial and forestry data needed to analyze your timber plantation investment. Go to any management data category and enter it by **Left Clicking** on the chosen data category button. After filling in one category, **Back** returns you to this organization window in a loop so that you can choose another category.

When you finish entering data in all the categories, press **Continue** to complete the analysis. If you ignore a page, TreeCents uses the default data stored in it as part of your respecified project. At every stage either **Help** or **Definitions** will answer many questions. **Quit** returns you to the TreeCents Introduction window.

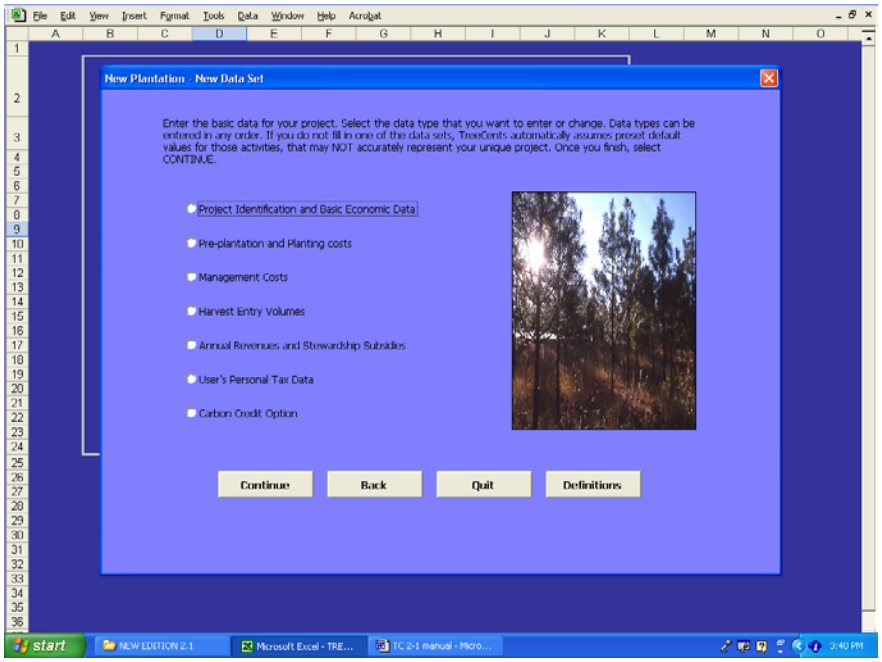
New Plantation - New Data Set
Enter the basic data for your project. Select the data type that you want to enter or change. Data types can be entered in any order. If you do not fill in one of the data sets, TreeCents automatically assumes preset default values for those activities, that may NOT accurately represent your unique project. Once you finish, select CONTINUE.
Project Identification and Basic Economic Data
Pre-plantation and Planting costs
Management Costs
Harvest Entry Volumes
Annual Revenues and Stewardship Subsidies
User's Personal Tax Data
Carbon Credit Option
Continue
Back
Quit
Definitions

Figure 7: Data organization window

TreeCents recognizes seven plantation data categories. Each category can be accessed for data entry in any order by clicking on the preferred category. The default case is a real plantation example to provide a data formatting guide. The default data is only a training demonstration and probably does not reflect your project's unique specifications. Write over or erase the default project as you build your own first project. By entering one

project and saving it, you create your own default case that will require only minor data changes from project to project.

3.5.2 Project Identification and basic economic data

There are five pages of project ID and basic data. Access each page by clicking on the file tabs. The tabs suggest an entry order, but you can enter or reenter in any order. There are four process assist buttons. **Reset** returns a page to its original default entries. **Back** takes you to the previous window. **Help** gives you definitions, explanations and warnings. It may also describe how TreeCents uses data and critical assumptions. **OK** says "I'm done!", and returns you back to the data organization window so you can start another data category.

Remember that TreeCents calculates all project criteria on an **average per acre basis**. Timber investments may be hundreds of acres, but you should apportion project level costs to their per acre equivalents.

3.5.2.1 Discount rate and inflation

This page (figure 8) labels each project's unique identity. Users should invent their own project labeling system logic so that they can keep track of all the projects that they have analyzed. For example, "NE 40 Doug-fir trial regime 6." TreeCents just reads the alpha-numeric label as written and copies it to reapply it where ever necessary, such as in subsequent data pages or in reports.

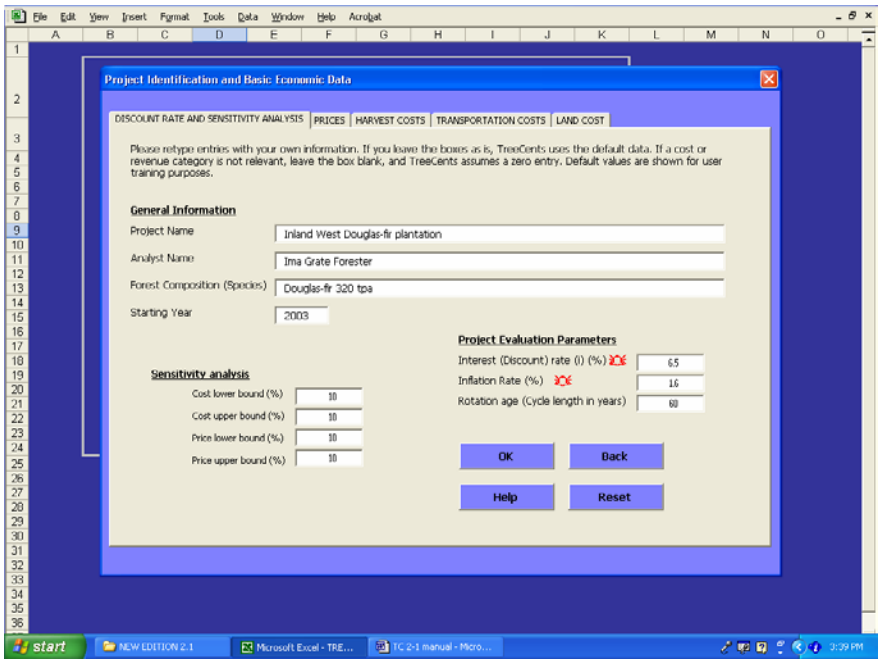

Figure 8: Discount rate and sensitivity page

Project evaluation parameters define the most mathematically influential variables. The interest rate corresponds to alternative earnings of invested capital (e.g. a certificate of deposit) expressed as an annual percentage (Klemperer, 1996). In financial analyses it adjusts (or discounts) future costs and prices into present equivalents, so it is called the "discount rate." By measuring the opportunity cost of capital tied-up long-term in a project, it represents how much the project money would have made in a savings account or alternative investment that would have earned that rate.

The discount rate has exponential mathematical effects, so it is the most critical economic variable in TreeCents. For example, a tree worth $100 in 50 years is worth $8.72 in today's equivalents at 5%, and only $0.85 at 10%. The discount rate is such an extremely sensitive variable, we suggest users reanalyze the project several times at various rates, if they have any doubt about their own appropriate rate.

TreeCents uses a "nominal" (including inflation) interest rate for discounting. Some sources call this a "guiding" rate. We use nominal discount rates because real discount rates (inflation removed) can be confusing to users and taxes are paid on nominal rather than real income. You should enter your own unique current bank rate to reflect the interest

costs of project financial capital. Use a rate that includes the right risk premium for your normal investments.

TreeCents also requires a general economic inflation rate entry. This can be the rate reported in the business pages of your newspaper. The program uses it to simplify the math of annuities. Remember, an **alarm bell** warns of an extremely important input. In this case, the nominal interest rate already includes inflation, so it has to be bigger than the inflation entry. **Having inflation > nominal interest will make calculations fail**.

The "rotation age" is simply the even-age cycle length from planting to final harvest measured in years. TreeCents recognizes that long-run even-age silviculture requires reestablishing stands after harvests, so it assumes that these plantation cycles repeat indefinitely. The rotation age should be the same number of years as you will enter for the timing of your last harvest entry.

3.5.2.2 Sensitivity analysis (same page)

"Sensitivity analysis" is a way of second-guessing economic data assumptions. Any project's future economic conditions are poorly known, expectations are little better than guess. TreeCents allows users to account for the variability of future events by bracketing their evaluation calculations with percentage adjustments to future cost and revenue streams. The pessimist bracket assumes higher future costs and lower future revenues than specified in the base case. The optimist bracket assumes lower future costs and higher future revenues.

Our default case entry uses ± 10 % for both costs and prices. This means costs and prices may vary between 90% and 110% of their best guess value. For example, if establishment costs are $200 per acre, in the optimistic scenario costs drop to $180 per acre (90% of a best guess value), and in the worst case, they rise to $220 per acre (110% of a best guess value). The same would happen for prices. As a result, the default pessimistic lower bound would have 10% higher costs and 10% lower prices, and the default optimistic upper bound scenario would have lower costs and higher prices.

Set your own sensitivity range. Fill in the percentages that you worry your prices may vary in the best and in the worst of situations. If you are worried about an extremely variable future use a larger size bracket. 10% entries are less certain (a larger adjustment of

both base costs and benefits) and a 5% entry means that you are more confident of future conditions. TreeCents reports both brackets to help users hedge and second-guess decisions that many analysts make only with base case financial criteria.

3.5.2.3 Timber prices page

Future timber harvest stumpage values vary by volume, location, species, logging costs and log quality. TreeCents calculates mature standing timber's "stumpage value" from known mill log values and logging costs. As TreeCents is designed for long-run investment evaluation, it is lower resolution than typical timber sale accounting programs. TreeCents recognizes up to six species value groups and five product type groups. Most users won't even use the whole matrix of thirty value group/product combinations. If you don't have this many, leave them blank or enter zero.

Design your own species value group labels to best reflect your timber project outputs. The labels carry over to other appropriate program label entries. You can be creative. As TreeCents computations use the entry as a multiplier, you can even violate the column label units. Just make sure that you are consistent in later data windows.

Log measure labels vary by expected product type. The default case expects that the highest quality butt logs might go either to export or plywood mills. There is a product category for domestic sawlogs that might sell to traditional random-length sawmills. Both of these log product categories are measured in MBF (thousands of Scribner board feet). Poles are another product category measured in MBF.

Small trees and some tops could go to high speed automated stud mills as tonwood (small diameter logs measured in green tons). Finally, high defect logs of all kinds may be sold to chip mills, pulp mills or biomass energy plants by the green ton.

Many plantations are single species, but TreeCents allows for complicated mixed species stand establishment and tracking natural volunteers. Enter the current reported **mill-delivered log values** for each of the thirty product value group combinations that you intend to use (figure 9). These values are often reported by state forestry agencies, log reporting services or consulting firms. Leave any unused cells zero or blank. TreeCents automatically adjusts log prices entries for expected price growth and inflation and stores them for later computations.

User Tip:

TreeCents keeps track of inflation. So enter costs for practices and revenues in today's values. TreeCents automatically inflates them to your specified time of occurrence. If you think costs or revenues will change at a rate more or less than inflation over the next 20 years, there are several places in TreeCents where you can specify this.

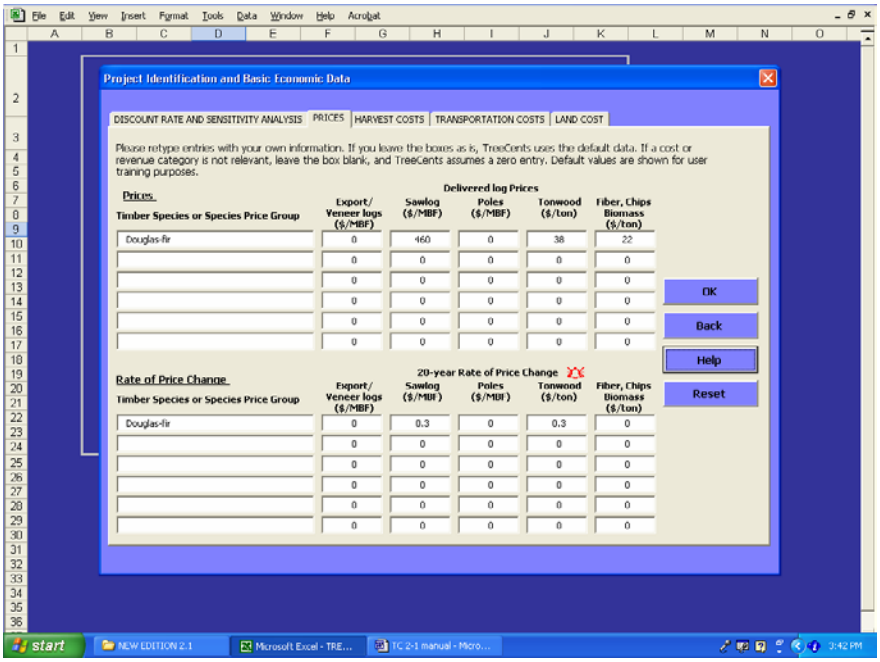
Project Identification and Basic Economic Data
DISCOUNT RATE AND SENSITIVITY ANALYSIS
PRICES
HARVEST COSTS
TRANSPORTATION COSTS
LAND COST
Please retype entries with your own information. If you leave the boxes as is, TreeCents uses the default data. If a cost or revenue category is not relevant, leave the box blank, and TreeCents assumes a zero entry. Default values are shown for user training purposes.
Prices
Delivered log Prices
Timber Species or Species Price Group
Export/ Veneer logs ($/MBF)
Sawlog ($/MBF)
Poles ($/MBF)
Tonwood ($/ton)
Fiber, Chips Biomass ($/ton)
Douglas-fir
OK
Back
Help
Reset
Rate of Price Change
20-year Rate of Price Change

Figure 9: Prices and price trends page

Prices change over time. TreeCents already recognizes inflation and adjusts for it, but sometimes long-run market shifts can cause price and cost trends that differ from inflation. Users may define different 20-year trends for the major price and cost categories. These may be either positive (e.g. caused by tightening log supplies) or negative (e.g. increased competition from other building products). They should be entered as an average percentage per year **in excess of, or below, expected inflationary changes**. TreeCents limits expected trend changes to 20 years. Percentage changes have large mathematical effects and markets usually adjust to stabilize prices and costs in the long run.

3.5.2.4 Harvest costs page

Harvesting costs include all the logging practices necessary to convert standing trees into logs loaded on a truck prior to hauling. Again, TreeCents is a long-run project calculator, not a timber sale evaluator, so resolution is lower. However, some log products require different logging steps and equipment, so TreeCents recognizes different average logging costs by product by unit of measure for each product type. Cost can be entered **either** by five logging cost categories **or** total logging costs—**NOT BOTH** (figure 10).

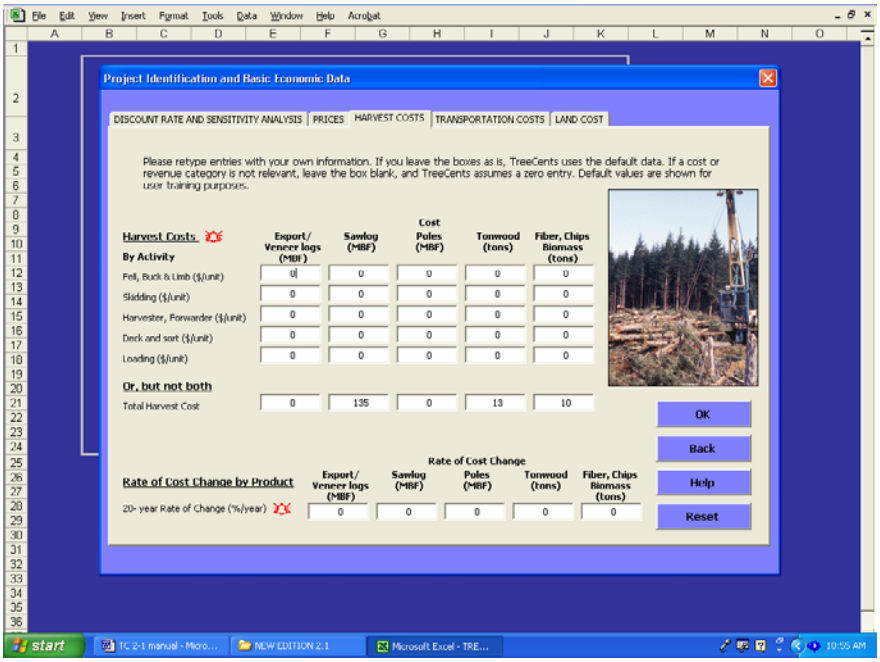
Project Identification and Basic Economic Data
DISCOUNT RATE AND SENSITIVITY ANALYSIS
PRICES
HARVEST COSTS
TRANSPORTATION COSTS
LAND COST
Please retype entries with your own information. If you leave the boxes as is, TreeCents uses the default data. If a cost or revenue category is not relevant, leave the box blank, and TreeCents assumes a zero entry. Default values are shown for user training purposes.
Harvest Costs
By Activity
Export/ Veneer logs (MBF)
Sawlog (MBF)
Cost Poles (MBF)
Tonwood (tons)
Fiber, Chips Biomass (tons)
Fell, Buck & Limb ($/unit)
Skidding ($/unit)
Harvester, Forwarder ($/unit)
Deck and sort ($/unit)
Loading ($/unit)
Or, but not both
Total Harvest Cost
135
13
10
OK
Back
Help
Reset
Rate of Cost Change
Rate of Cost Change by Product
20- year Rate of Change (%/year)
start

Figure 10: Harvest costs page

Either enter estimated per unit costs by the five logging cost categories **OR** enter a total logging cost per unit estimate for each product. The summary logging cost entry would include all the felling, limbing, bucking (or a harvester), skidding (or forwarding), sorting, and loading costs. Data can come from your experience, or bids might be given by loggers to landowners for each sale, or you can use current estimates from other sales in your vicinity. **DO NOT USE BOTH COST ENTRY FORMATS** as double entries make TreeCents assume that your logging is twice as costly. Fixed harvest entry costs can vary from entry to entry, so TreeCents asks for these on the individual harvest entry pages.

Logging costs can also change over time although they typically change much more slowly than log prices. TreeCents automatically adjusts for inflation. As in the price page, users may define different 20-year trends for major cost categories. These may be either increases (e.g. caused by regulatory constraints) or decreases (e.g. more efficient technology). They should be entered as an average percentage per year **in excess of, or below, expected inflationary changes**. TreeCents limits these trend changes to 20 years.

3.5.2.5 Transportation costs page

Transportation costs include log hauling, delivery, unloading and any extra scaling costs. These are entered in a cost summary format measured in $ per haul mile per log unit for each of the five product types. You can get estimates of these costs from log truckers or your neighbors experiences. TreeCents recognizes that more owners are increasing returns by merchandizing their log products to different buyers, so it allows users to test log delivery to five different spatially separated mills by product type (figure 11). 20-year cost trends (greater or less than inflation) can also be entered on this page.

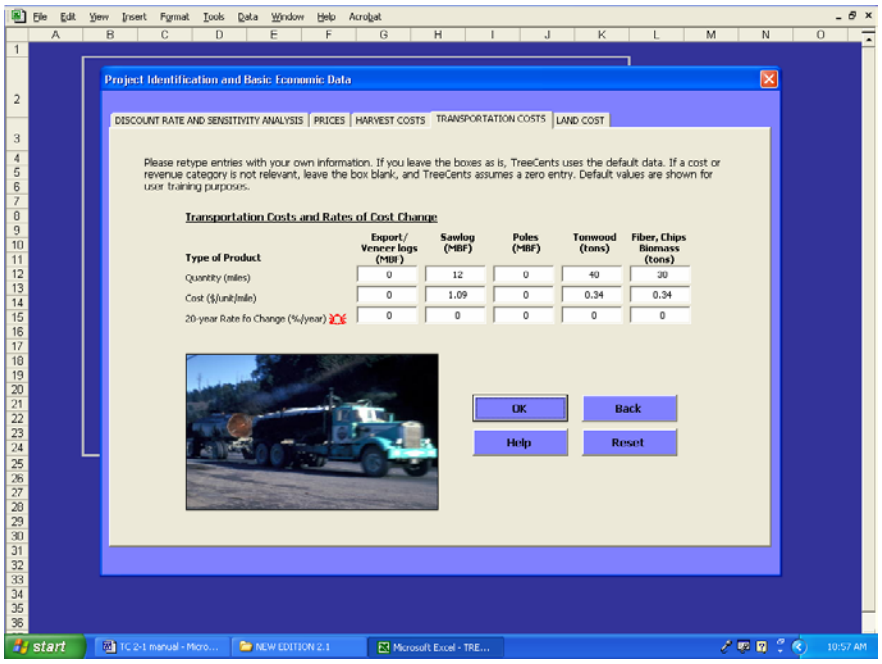
Project Identification and Basic Economic Data
DISCOUNT RATE AND SENSITIVITY ANALYSIS
PRICES
HARVEST COSTS
TRANSPORTATION COSTS
LAND COST
Please retype entries with your own information. If you leave the boxes as is, TreeCents uses the default data. If a cost or revenue category is not relevant, leave the box blank, and TreeCents assumes a zero entry. Default values are shown for user training purposes.
Transportation Costs and Rates of Cost Change
Type of Product
Export/ Veneer logs (MBF)
Sawlog (MBF)
Poles (MBF)
Tonwood (tons)
Fiber, Chips Biomass (tons)
Quantity (miles)
Cost ($/unit/mile)
20-year Rate fo Change (%/year)
OK
Back
Help
Reset

Figure 11: Transportation costs page

Transportation costs are spatially sensitive. Enter the road miles to each mill so TreeCents can internally calculate the total log delivery costs by product by destination. Playing with this for different log markets helps you optimize timber sales prescriptions for any single harvest or even to strategically redesign your forest production to serve your local wood market layout.

3.5.2.6 Land cost page

For plantations, TreeCents calculates how project design redefines bare land value estimates. The primary evaluation criterion is Soil Expectation Value (SEV), an absolute measure of project performance. The highest possible SEV across plantation options can be interpreted as bare timberland value.

The land cost entry (page not shown) is a supplemental estimate of immediate bare land liquidation value. The land cost entry can be set at zero or ignored without affecting SEV. However, TreeCents uses land cost to calibrate and normalize other relative financial criteria so they are comparable. This way bare land timber project performance can be logically compared to other land use profitability. This is particularly a problem in existing stands because otherwise, the initial project capital includes standing timber with significantly higher liquidation values has a capital scale bias. An that warns you about ignoring this entry. If land cost = zero, you get N/A in comparison financial reports.

3.5.3 Preplantation and planting costs

Establishing a plantation takes up to two years for site preparation, planting and protection of new seedlings. This window (figure 12) allows users to list costs of all the user-specific practices in the years zero and 1 as needed. TreeCents sums these early establishment costs separately as their federal income tax treatment is significantly different. TreeCents assumes you are an “active” manager under IRS timber tax rules and automatically calculates the 8-year tax planting cost amortization, including the 10% federal income tax credit on 95% of the costs, and deductions against ordinary income.

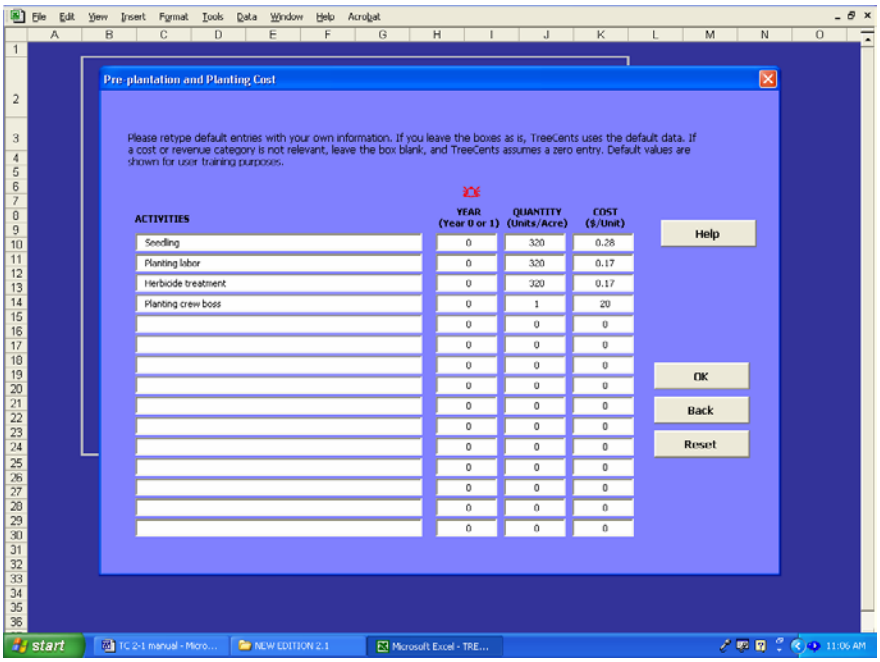
Pre plantation and Planting Cost
Please retype default entries with your own information. If you leave the boxes as is, TreeCents uses the default data. If a cost or revenue category is not relevant, leave the box blank, and TreeCents assumes a zero entry. Default values are shown for user training purposes.
ACTIVITIES
YEAR (Year 0 or 1)
QUANTITY (Units/Acre)
COST ($/Unit)
Seedling 0 320 0.28
Planting labor 0 320 0.17
Herbicide treatment 0 320 0.17
Planting crew boss 0 1 20
Help
OK
Back
Reset

Figure 12: Preplantation and planting costs window

3.5.4 Management costs

TreeCents recognizes six categories of management costs on separate data entry pages (example figure 13). Management costs are of three types: infrequent timber stand improvement (TSI) costs, other irregular costs, and annual costs. TSI costs include fertilization, pruning, precommercial-thinning.

For each category, costs are simply listed on the appropriate page along with the year of occurrence (from investment starting year zero), the units of activity per acre, and the cost per unit. Other irregular costs may also be listed on these pages as TreeCents treats most cost categories similarly. An important tax distinction is that TreeCents automatically capitalizes TSI cost page entries. Irregular costs and annual costs are expensed.

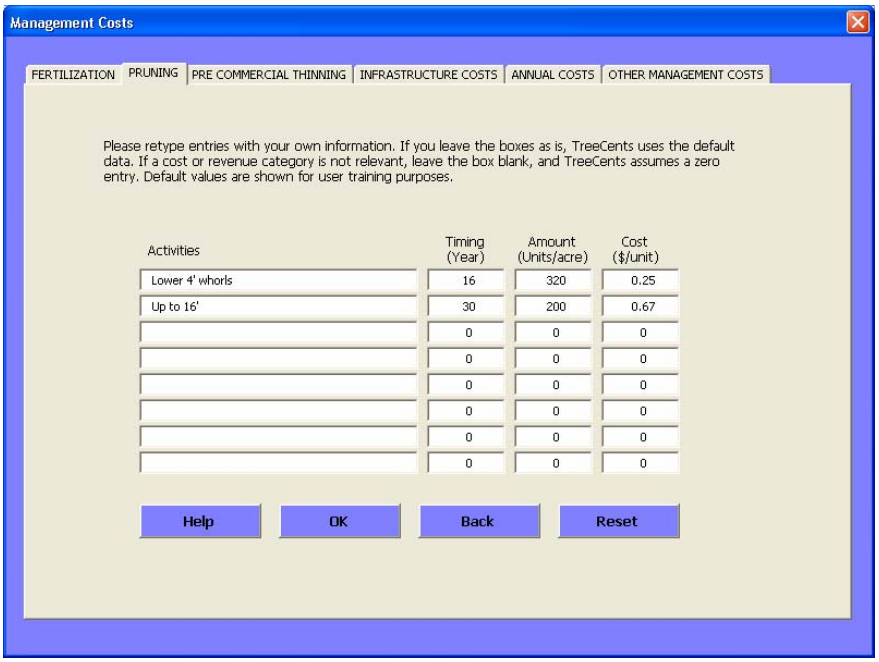
Management Costs
FERTILIZATION
PRUNING
PRE COMMERCIAL THINNING
INFRASTRUCTURE COSTS
ANNUAL COSTS
OTHER MANAGEMENT COSTS
Please retype entries with your own information. If you leave the boxes as is, TreeCents uses the default data. If a cost or revenue category is not relevant, leave the box blank, and TreeCents assumes a zero entry. Default values are shown for user training purposes.
Activities
Timing (Year)
Amount (Units/acre)
Cost ($/unit)
Lower 4' whorls 16 320 0.25
Up to 16' 30 200 0.67
Help
OK
Back
Reset

Figure 13: Typical management cost page

Fertilization is changing the nutrient balance of an acre usually by adding nitrogen and trace minerals. In the Inland West, nitrogen ($N_{2)}$ is often added to stimulate growth and potassium (K) is added to improve stand resilience to insects and diseases. West coastal forests have also experimented with composting and adding sewage sludges to forest sites. Repetitive fertilization is entered as successive lines.

User Tip

If you fertilize, trees should grow faster for 10 to 15 years. Make sure that you use appropriate larger harvest yield assumptions that show grow these responses.

Pruning is removing live or dead branches close to the bole from a standing tree with the purpose of improving the tree form or its timber quality (Helms, 1998). The program needs the investment year of pruning (from start year zero), the activity number of units per acre (bids can be in per tree or per acre terms) to accomplish pruning, and the cost in dollars per unit. If pruning is more than one lift, enter successive lifts on separate lines.

User Tip

Pruning usually increases wood values by raising the grade of the first log. Remember to increase your highest grade log value category accordingly in the price window.

Thinning removes some percentage of trees to reduce the stand density and improve the growth rate of remnant trees (Helms, 1998). Precommercial thinning has costs, but no revenues. Enter the year of thinning, the activity units required to do thinning. Either enter the number of trees to be thinned and a price per tree, or bids for per acre (enter 1 in units) thinning project and the cost per acre. In commercial thinning felled trees are extracted and sold as products. TreeCents treats commercial thinning as revenue generating intermediate harvest entries that are covered in harvest entry pages later.

User Tip

Thinning reduces future harvest total volumes, but should increase values of remaining trees as concentrated site growth increases their size and grade by sale date. Remember to reduce harvest volumes and increase log values accordingly.

Infrastructure costs are expenditures made on temporary deductible land improvements. Examples include temporary skid trails, road maintenance, access gating, among others. As these costs often serve multiple acres, remember to reallocate their magnitude down to a per acre equivalent. Permanent structures are not project specific. They serve your entire property over a long capital life, so they should be tracked and depreciated separately in your IRS improvements account for a different tax treatment.

TreeCents tax treatment varies by cost category. TreeCents capitalizes TSI practice costs categories as required by the IRS instead of expensing them for federal income taxes. These include: fertilization, pruning, and precommercial thinning. That means their costs are carried over and deducted against the next harvest income. All other costs are expensed in the year of occurrence. TreeCents is unable to carry over tax losses except as deductions against ordinary income from other sources. TreeCents assumes that you are an "active" manager as defined by IRS to enjoy this deduction. If you are in doubt about your "active" status, check www.timbertax.org for additional insights.

The annual cost page is identical to other cost pages except it is missing the cost year entry. Annual costs are assumed to occur every year at the same level. Examples include: fire protection district fees, property taxes, and administration fees. TreeCents needs only number of units per acre (or "1" to represent a whole acre-wide practice) and the initial year cost estimate in current terms. As annual costs usually rise with inflation, TreeCents automatically calculates the previously entered inflation effect in both the cost series and in discounting.

3.5.5 Harvest entry volumes

TreeCents recognizes up to four possible harvest entries during a rotation cycle (figure 14). This allows for up to two commercial thins and a regeneration harvest during a rotation cycle. For plantations, earlier capitalized costs are summed and deducted from the next taxable stand revenue.

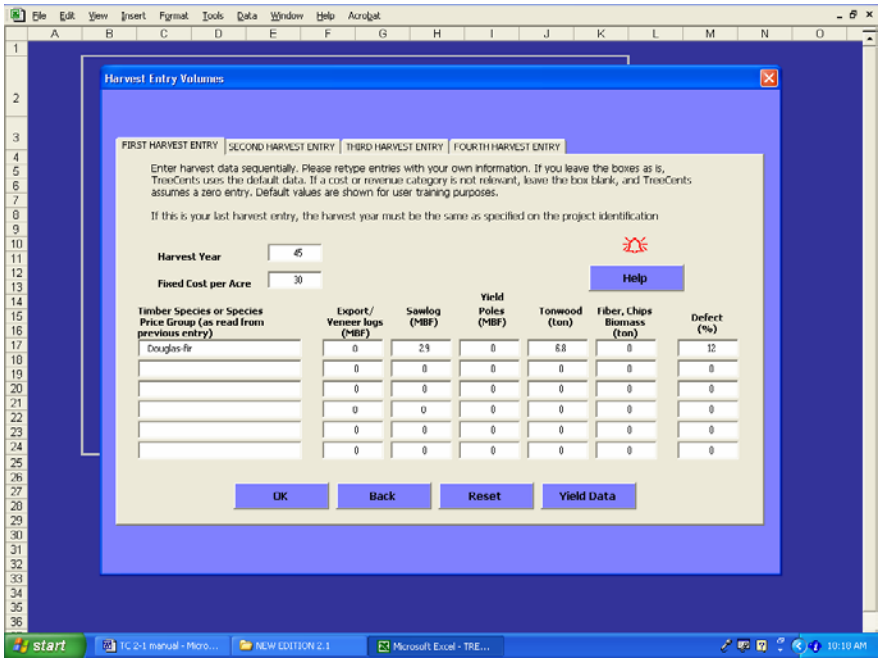
Harvest Entry Volumes
FIRST HARVEST ENTRY
SECOND HARVEST ENTRY
THIRD HARVEST ENTRY
FOURTH HARVEST ENTRY
Enter harvest data sequentially. Please retype entries with your own information. If you leave the boxes as is, TreeCents uses the default data. If a cost or revenue category is not relevant, leave the box blank, and TreeCents assumes a zero entry. Default values are shown for user training purposes.
If this is your last harvest entry, the harvest year must be the same as specified on the project identification
Harvest Year
45
Fixed Cost per Acre
30
Help
Timber Species or Species Price Group (as read from previous entry)
Export/ Veneer logs (MBF)
Sawlog (MBF)
Yield Poles (MBF)
Tonwood (ton)
Fiber, Chips Biomass (ton)
Defect (%)
Douglas-fir
OK
Back
Reset
Yield Data

Figure 14: Typical harvest entry volume page

Fill in harvest entry data pages in chronological order! Some later cash flows (esp. taxes) are conditional on previous harvests

The harvest year entry is the number of years (e.g. 50 years) since stand establishment in year zero. Do not enter a date here (e.g. 2005), or TreeCents will assume rotation cycle lengths thousands of years long. You'll never live to see them, besides discounting revenues for that long makes them really tiny. The fixed cost entry allows users to enter a fixed per acre harvest cost that is unique to that harvest entry.

Each harvest entry has its own page, but all four have identical formats. If you plan **less than four harvests**, enter intermediate harvests in order starting on harvest page 1. Make sure any unused harvest pages at the end have zero entries. Your last harvest of this regime's cutting pattern **must have a harvest year corresponding to the rotation cycle length** that you specified on the project identification page earlier. Otherwise your SEV and NPV calculations will have a built-in error.

Once a plantation establishment and harvest pattern is entered, TreeCents assumes that pattern cycle would repeat indefinitely. However, the contribution to present value of a distant future cycle can be quite small, particularly in slower growing forests. This financial effect is visible in a comparison of project financial criteria. NPV (present value of a single cycle) will be slightly smaller than SEV (present value of infinite cycles).

Timber financial analyses are driven to a large extent by expected physical harvest volumes—i.e. how fast your trees grow. However, future volumes are extremely variable by soil productivity, climate, stand age, management treatments and the mix of tree species and size classes left by previous harvests. Be consistent within any one project analysis. Use yield data specific to your project conditions.

TreeCents does not predict timber yields, it only calculates their financial implications. Timber yields are highly variable, and unique to silvicultural regimes and different land qualities. Predicting yields is a big job for dedicated and complicated growth and yield simulators. You need quantitative yield estimates from simulators, your own experiences or another knowledgeable source such as a consulting forester or a forestry extension agent. TreeCents needs estimates of specific gross harvest volume estimates for each harvest page by each species value group and by product type. If you really have detailed data, TreeCents also has percent defect entries that reduce gross volumes to net scalable volumes for sawn products as log payments are based on net scale.

Of course, you may supply less detailed or accurate guesstimates, and still get approximate financial criteria that will aid decisions, but you will weaken their reliability. TreeCents contains some example embedded growth and yield data to help you visualize how tree stands typically grow. This data is included as a default for user familiarization and demonstration purposes only. In any harvest entry page click on **Yield Data** . Follow the buttons for different yield types to a set of example yield tables and yield curves (figure 15) for some typical timber stands in this region.

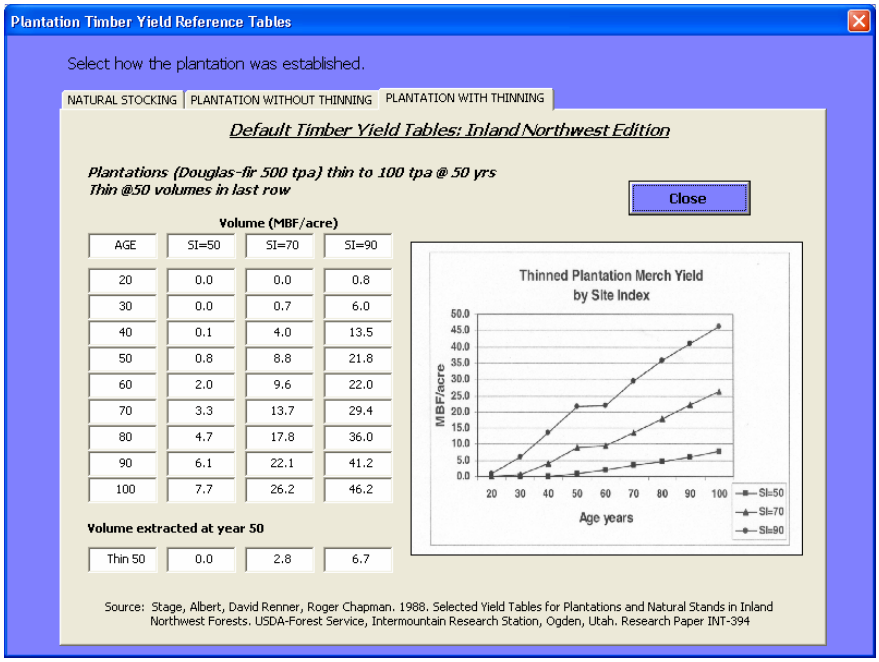
Plantation Timber Yield Reference Tables
Select how the plantation was established.
NATURAL STOCKING
PLANTATION WITHOUT THINNING
PLANTATION WITH THINNING
Default Timber Yield Tables: Inland Northwest Edition
Plantations (Douglas-fir 500 tpa) thin to 100 tpa @ 50 yrs
Thin @50 volumes in last row
Close
Volume (MBF/acre)
AGE SI=50 SI=70 SI=90
20 0.0 0.0 0.8
30 0.0 0.7 6.0
40 0.1 4.0 13.5
50 0.8 8.8 21.8
60 2.0 9.6 22.0
70 3.3 13.7 29.4
80 4.7 17.8 36.0
90 6.1 22.1 41.2
100 7.7 26.2 46.2
Volume extracted at year 50
Thin 50 0.0 2.8 6.7
Thinned Plantation Merch Yield
by Site Index
MBF/acre
Age years
SI=50
SI=70
SI=90
Source: Stage, Albert, David Renner, Roger Chapman. 1988. Selected Yield Tables for Plantations and Natural Stands in Inland Northwest Forests. USDA-Forest Service, Intermountain Research Station, Ogden, Utah. Research Paper INT-394

Figure 15: Typical yield table & curves

The thinned plantation example in figure 15 shows how harvestable tree volume accumulates with age. Higher site quality land produces substantially higher volumes over time. Managed stands typically produce more than unmanaged. This example demonstrates how early thinning affects later volumes. Thinning can reduce future harvest total volumes, but can have substantial offsetting benefits. It increases stand health, concentrates stand growth on to higher quality-higher valued logs, and yields an early small revenue that isn't discounted away. Many users thin for other reasons such as aesthetics and wildlife habitat quality. Remember to coordinate your thinning activities with your harvest volume and price assumptions.

Make sure that your yield and harvest value assumptions match the management in each project variant. For example, thinning and pruning stands will significantly raise log quality, change volumes and increase expected log sales prices. Whether this value gain offsets the higher early rotation costs is something that TreeCents will explicitly tell you.

User Tip

Timber yield variability and its large effects on financial criteria suggests that users should invest some effort in learning to use yield simulators to better represent their forest's timber potential. Options for western timber stands include: (1) the USFS Forest Vegetation Simulator (FVS), and (2) the Arney Stand Projection System (SPS).

3.5.6 Annual revenues

Annual revenues are those that occur at the same level every year *ad finitum* (except as affected by inflation). TreeCents recognizes two types in this category.

3.5.6.1 Annual sales revenues

Examples include: grazing leases or floral greens contracts. The annual revenues page has the same open label, units, and values listing format as found in annual costs. Their mathematical treatment is quite similar. TreeCents automatically adjusts for inflation over the annual payment stream. Enter label, number of units per acre, and values per unit.

3.5.6.2 Stewardship subsidy revenues

Many private forests qualify for incentive payments from public agencies. Examples include, silvicultural practice cost shares, timber stand improvement incentives, conservation reserve payments, wildlife habitat enhancement etc. TreeCents recognizes that subsidies come in two forms: (1) discrete incentive payments, and (2) short annual spans of payments. You label and choose figure 16 entries as you see fit. Although TreeCents is organized as two payments, each having a single plus annuity subsidy, the mathematical treatment is such that you can separate these as needed. Carbon credit and stewardship subsidy annual revenues are treated in separate category windows.

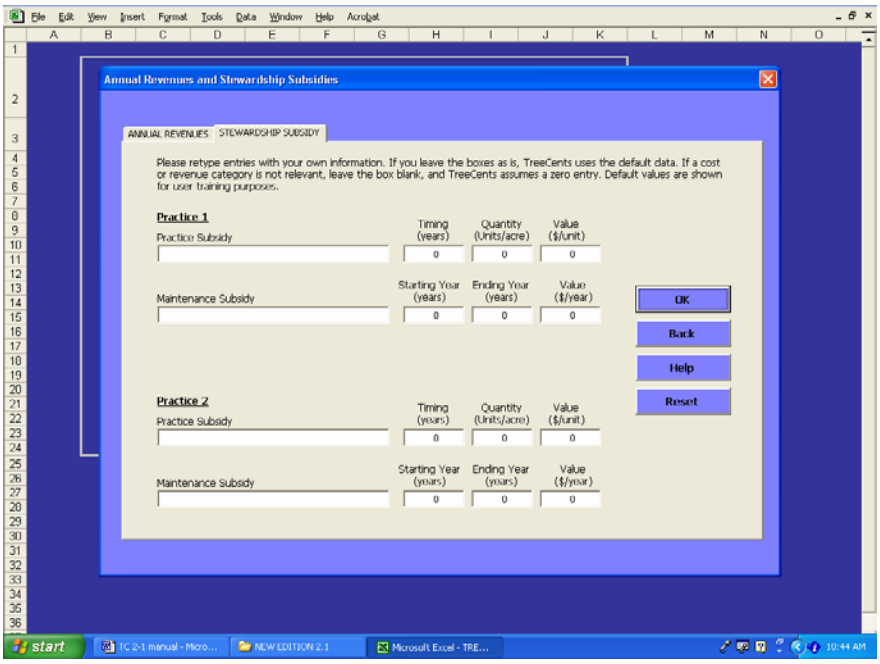

Figure 16: Stewardship subsidy page

3.5.7 User's personal tax data

Timber investment profitability rises and falls on its tax treatment and each user's tax situation is unique. TreeCents calculates before-tax financial criteria as well as after-tax criteria so that tax effects and sometimes tax benefits are explicit. Our experience is that many private forest owners are unfamiliar with the tax advantages of timber investments and pay way too much in taxes. If you find yourself in this deluged demographic group, log on to www.timbertax.org soon and self-educate.

TreeCents will calculate the very complex and conditional financial implications of many generic tax systems including: federal and state ordinary net income taxes; federal and state capital gains taxes, ad valorem property taxes, yield and severance taxes separately or in any combination. The personal tax data page entries (figure 17) should be tailored to each user's individual tax profile.

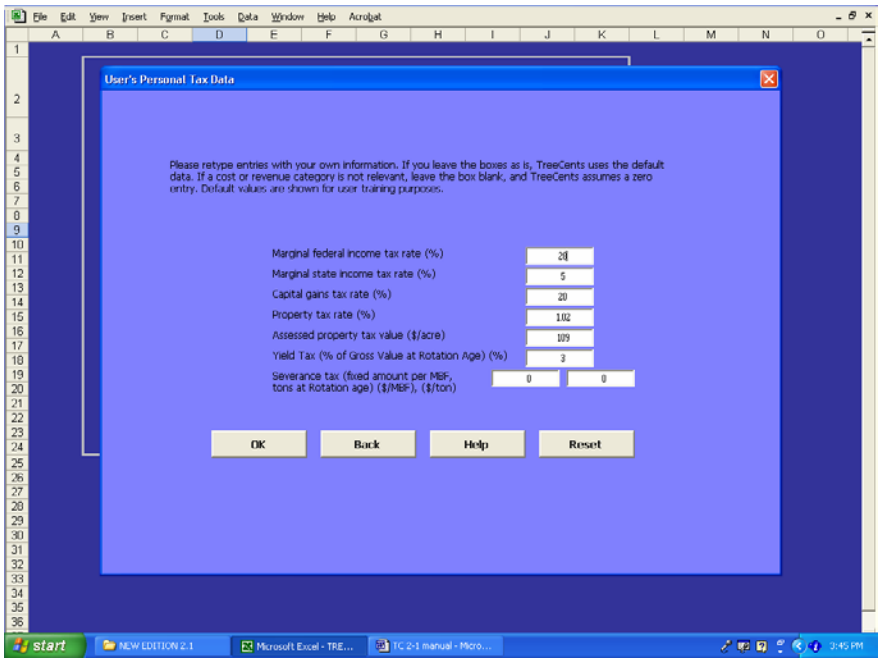
User's Personal Tax Data
Please retype entries with your own information. If you leave the boxes as is, TreeCents uses the default data. If a cost or revenue category is not relevant, leave the box blank, and TreeCents assumes a zero entry. Default values are shown for user training purposes.
Marginal federal income tax rate (%)
Marginal state income tax rate (%)
Capital gains tax rate (%)
Property tax rate (%)
Assessed property tax value ($/acre)
Yield Tax (% of Gross Value at Rotation Age) (%)
Severance tax (fixed amount per MBF, tons at Rotation age) ($/MBF), ($/ton)
OK
Back
Help
Reset

Figure 17: User's personal tax data page

3.5.7.1 Ordinary and capital gains income taxes

Timber income can be subject to both federal and state taxes of two types: (1) ordinary income taxes, and (2) capital gains income taxes. Ordinary income is like wages and interest. These incomes are typically taxed at higher rates with supplemental taxes (usually 15.3%) for self-employment taxes. Enter your marginal (highest applicable tax bracket) federal and state income tax rates in percentage terms. Capital gains taxes are lower taxes due on the sale of long-term capital assets (held more than 1 year) and no self-employment taxes apply. Again enter your applicable federal and state capital gains rates in percentage terms. Some states such as Idaho, have capital gains exclusions instead, so convert them into equivalent percentage rates. For example, a 60% capital gains exclusion is the same as a 40% of income taxable with an 8% state ordinary income tax rate equates to (0.4 x 0.08 = 0.032 or 3.2 per cent).

A complicating factor is that state tax payments are typically deductible in calculating federal income taxes. TreeCents solves this by converting your separate entries into a single post-deduction effect tax coefficient for each tax category. You no longer have to adjust for this interaction yourself.

3.5.7.2 Timber and property taxes

State and local timber taxes can be particularly variable between jurisdictions. TreeCents can be adapted to many different tax system combinations by choosing your tax data entry appropriately. Users should specify their situation and zero out other options. Some states have constant annual *ad valorem* property taxes called forest productivity taxes. A small annual land productivity tax coupled with a harvest yield or severance tax is common elsewhere. A yield tax is a percentage of gross harvest revenues so enter this one in percentage terms. A severance tax is a fixed payment rate on harvest volumes. TreeCents allows for different rates for board and tonnage volume units.

This category gets really messy sometimes. Some western states call their yield taxes severance taxes, but use TreeCents definitions (consistent with national tax literature) please to make the math work. In Idaho, forest owners may change between a productivity tax or land and yield every ten years. Finally, these taxes are deductible against income taxes. Not-to-worry, TreeCents takes care of tax system interactions automatically for you.

There are more critical analytical assumptions embedded in TreeCents tax calculations than anywhere else. TreeCents assumes that this single acre is managed in the contest of other timber investments and in the context of other ordinary income. TreeCents assumes that tax-minimizing timber owners will be "tax savvy active" managers. Tax savvy implies that owners know the tax regulations and how to profit from them. "Active" managers are those who log 100 hours or more annually in tree farm activities (or pass other tests of activity). Be one! IRS "active" managers with other ordinary income sources (>90% of NIPF owners) may deduct of timber expenses against ordinary income in the expense year, rather than carrying them over to deduct them against future timber incomes.

Active managers may amortize site prep and planting costs rather than capitalize. This gives a 10% investment tax credit on 95% of planting costs as well as 8 years of up-front deductions against ordinary income. This can create substantial tax benefits. Private forest owners in high ordinary income tax brackets may be pleasantly surprised to find significant tax advantages of plantations. Sometimes there are even higher after-tax returns than before-tax returns. I'll repeat that. Done correctly, timber plantations can be a good tax shelter. This automatic tax cross-deduction feature can be turned off by zeroing out the

ordinary marginal federal and state income tax rate entries. For other important insights into minimizing tax loads, see the national timber tax web site: www.timbertax.org.

3.5.8 Carbon credit option

New plantations fix carbon and mitigate industrial emissions of carbon-dioxide. Although the global warming treaty has not been signed by the U.S. Congress as of this publication date, you may want to include the possibility of being paid to sequester atmospheric carbon. The Kyoto accord on mitigating atmospheric carbon dioxide could develop into a significant market for timber project carbon credits. There are already instances where emitters subsidize new timber plantation establishment and rent the carbon credits produced until the timber is harvested. As most carbon sequestration contracts are > 40 years in duration, this annual payment is mathematically treated as a revenue annuity.

3.6 Automatic TreeCents project calculations

Now its time to do TreeCents calculations. Relax, it has already been done for you automatically. While you were entering data, TreeCents was taking it from the templates, rearranging it for the right formulas in different modules and assembling the results for your reports. Your project results are ready to read.

4.0 TreeCents DATA SETS AND REPORTS

TreeCents has been automatically calculating summaries and results during the time you have been entering data. After completing all the categories on the data organization window, press **Continue** to find the output reporting paths. These summary report files exist even before you have finished entering all categories, but will be incomplete and erroneous if you enter them before you have all the project entries made. This is a good place to review your project specifications for accuracy before drawing conclusions from the final investment criteria.

4.1 Saving TreeCents data sets

You are first asked whether you want to save your new project data or read reports. We believe in backing up work every time that it is possible. Press **Save New Data Set**

and TreeCents first warns you what to expect in the save routine. Then it automates saving the project data in typical EXCEL data set files that can be located in any directory of your choice. TreeCents uses EXCEL to navigate into your desired save location. You can either write over a previous file by using the same file name or creating a new file specification by changing the file name. We suggest a character file name for individual projects with a numeric suffix for specification variants. **Warning! Do NOT try to Cancel from the EXCEL file list!**

These data sets are organized and well-labeled so you can read them in EXCEL without TreeCents. If you print them out they make good project variant references in a management plan appendix. If you are working with a forestry consultant who also uses TreeCents, you can send TreeCents data files back and forth electronically and use them to communicate regime fine-tuning suggestions.

4.2 Summary reports

All report windows have similar tabular formats and program functions. You can view reports on screen. Some are several pages long so you may have to scroll down. You can **Print** them for immediate hard storage. The print routine automatically transfers a formatted print file to the default printer.

4.2.1 TreeCents cost summary report

This report lists the cost data almost as you entered it without inflation adjustment or trending as they can be hard to interpret. The data has been converted into a total cost per acre by type format rather than in per unit terms. It is also reordered in a long multiple page categorical list so that you can check it easily for accuracy and completeness. There will often be many blank spaces as very few projects come close to using up the specification capacity of TreeCents. It is a good idea to assemble a complete project file of all reports for a particular project.

4.2.2 TreeCents revenue summary report

Revenues are also calculated into per acre equivalents by type. Check them for accuracy and completeness. Although revenues are also in a categorical list, there are

fewer revenue categories than for costs. None of the inflation or market trend adjustments are shown to keep the lists intelligible.

4.2.3 TreeCents individual project financial criteria report

You have a shunt window that offers you a choice between a single project report or a multiple project comparison report. Pick the single project for the tutorial as the comparison report requires that TreeCents be loaded with a wide range of land use projects for the same acre. You should now be looking at the individual project financial summary report (figure 18).

Evaluating this report's financial criteria is discussed in detail in section 5. This brief introduction will get you started, but make sure you study the complete explanation before you use TreeCents criteria for any spendy investments.

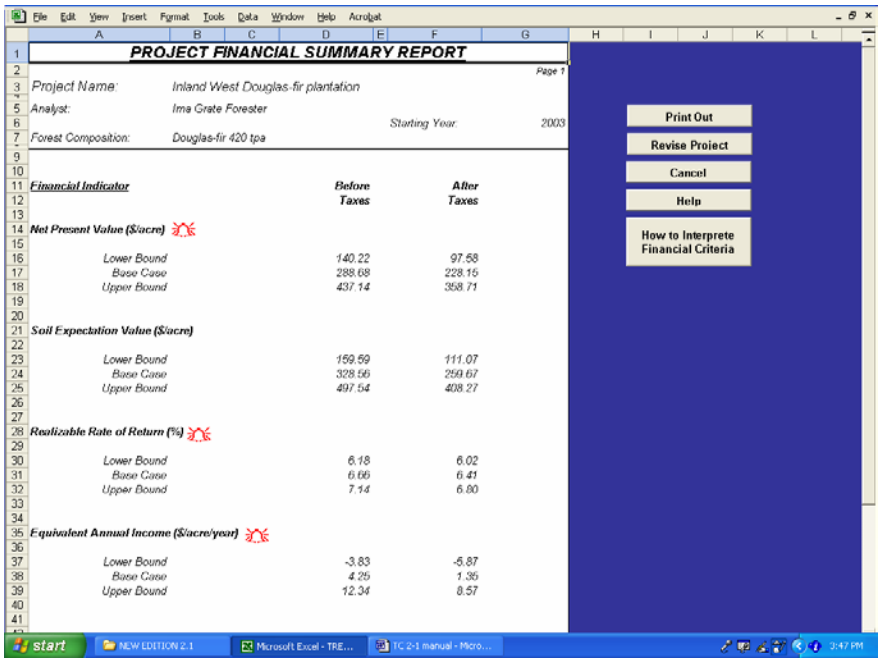

Figure 18: Individual project financial report

The individual project financial report will probably be your most useful. It gives you a spread of two absolute financial criteria and two relative ones. Each criterion is

calculated for your best guess "base case" specification and bracketed by both your upper optimist and lower pessimist scenarios. If you specified tax parameters, the left column is before-tax (or no-tax) criteria and the right column is in after-tax terms. For most non-industrial private forest owners, the after-tax criteria will be the most relevant.

The financial summary report has the same operational functions as the cost and revenue reports, but it includes a reference window option to help you interpret each of the criteria. You will also find a jump navigation button in this report. Older TreeCents versions required users to back down the analysis trail to make revisions. Newer versions have a **Revise Project** button that takes you right back to the correct project start window. This greatly speeds up the project redesign process and sensitivity analyses.

User Tip:

Rerun the same project several times with changes in the practices and outcomes. This is an easy way to search for a timber investment's most profitable management regime. Make a permanent record of variants for your management plan. Relabel each variant and save data sets and reports together.

4.2.4 TreeCents comparative project financial report

The comparative projects report has the same format as the individual report, but results are repeated in columns for each of four possible land use projects. The comparative project report displays all four criteria for four active projects simultaneously (figure 19). This is an advanced report that requires users to enter data for several different project types before use. In this tutorial, your plantation investment is being compared to three unrelated default training examples. At this stage comparative project criteria will have little meaning to you.

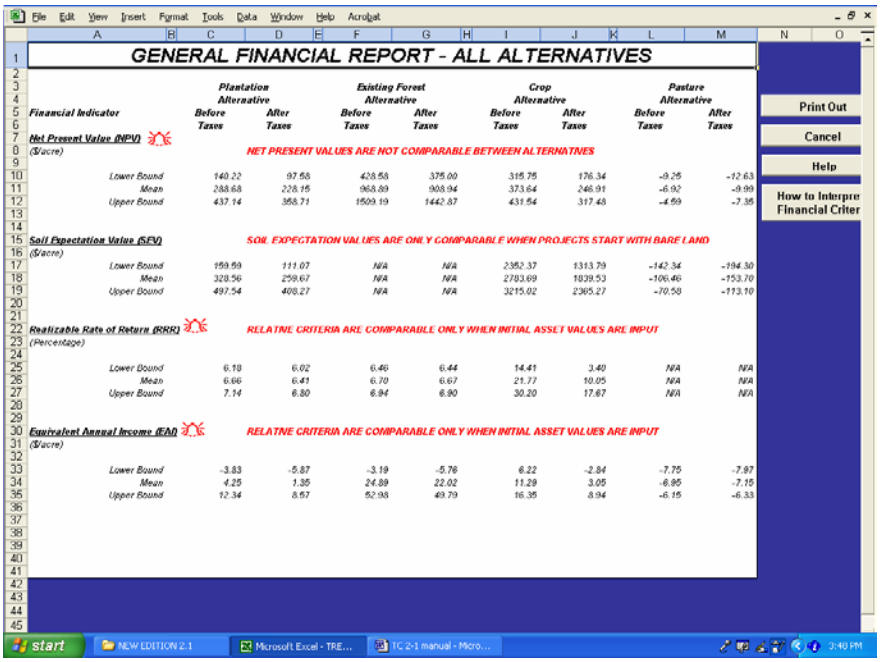
GENERAL FINANCIAL REPORT - ALL ALTERNATIVES
Plantation Alternative
Existing Forest Alternative
Crop Alternative
Pasture Alternative
Financial Indicator
Before Taxes
After Taxes
Net Present Value (NPV)
($/acre)
NET PRESENT VALUES ARE NOT COMPARABLE BETWEEN ALTERNATIVES
Lower Bound 140.22 97.58 428.58 375.00 315.75 176.34 -9.25 -12.63
Mean 288.68 228.15 968.89 908.94 373.64 246.91 -6.92 -9.99
Upper Bound 437.14 358.71 1509.19 1442.87 431.54 317.48 -4.59 -7.35
Soil Expectation Value (SEV)
($/acre)
SOIL EXPECTATION VALUES ARE ONLY COMPARABLE WHEN PROJECTS START WITH BARE LAND
Lower Bound 159.59 111.07 NA NA 2352.37 1313.79 -142.34 -194.30
Mean 328.56 259.67 NA NA 2783.69 1839.53 -106.46 -153.70
Upper Bound 497.54 408.27 NA NA 3215.02 2365.27 -70.58 -113.10
Realizable Rate of Return (RRR)
(Percentage)
RELATIVE CRITERIA ARE COMPARABLE ONLY WHEN INITIAL ASSET VALUES ARE INPUT
Lower Bound 6.18 6.02 6.46 6.44 14.41 3.40 NA NA
Mean 6.66 6.41 6.70 6.67 21.77 10.05 NA NA
Upper Bound 7.14 6.80 6.94 6.90 30.20 17.67 NA NA
Equivalent Annual Income (EAI)
($/acre)
RELATIVE CRITERIA ARE COMPARABLE ONLY WHEN INITIAL ASSET VALUES ARE INPUT
Lower Bound -3.83 -5.87 -3.19 -5.76 6.22 -2.84 -7.75 -7.97
Mean 4.25 1.35 24.89 22.02 11.29 3.05 -6.95 -7.15
Upper Bound 12.34 8.57 52.98 49.79 16.35 8.94 -6.15 -6.33
Print Out
Cancel
Help
How to Interpre
Financial Criter
start
NEW EDITION 2.1
Microsoft Excel - TRE...
TC 2-1 manual - Micro...
3:40 PM

Figure 19: Comparative projects financial report

When you do begin comparing between unlike land uses, use caution! Absolute criteria are comparable only when comparing different uses of the same initial assets over the same investment horizon. For example, if the same bare land acre is being evaluated for a timber plantation, or crops or grazing, the SEV's and NPV's accurately indicate the value attributed to the same acre by the different uses. If you are comparing existing forest NPV's to crop NPV's, watch out!

Comparing projects with different initial capital asset values have an unlike capital scale interpretive problem. Bigger to start with is usually better to end with—you haven't learned anything new. Existing forest projects should always have larger NPV's because more than bare land (e.g. land plus trees) is being compared to just bare land. There is another interpretation problem. Existing forests are evaluated over one cycle of five harvests. Plantations are evaluated for infinite cycles of with up to five harvests in each one. **Warning! In either case, absolute criteria are NOT directly comparable!**—except between different project variants from the same starting condition.

You will find relative criteria quite useful for such problem incomparabilities. Relative criteria ARE comparable between very different projects from different starting assets as long as the results have been normalized, i.e. initial estimates of the liquidation

values for all the different projects have been entered in TreeCents' project identification windows so that they can be used as rate adjustment factors.

5.0 INTERPRETING PROJECT CRITERIA

This is an important section for forest owners who are mystified or put off by the arcane theories of economics or finance. We've distilled all the theories of project evaluation into a brief, and hopefully clear, synopsis to make financial criteria painless and useful. Here goes…..set your snooze alarm.

In making long-run decisions, humans typically weigh future costs and benefits as less important than immediate costs and benefits. This "time preference" is measurable and is formalized mathematically by discounting future events using a decision maker's appropriate "rate of preference." For most of us, our financial rate of time preference is measured by that risk-adjusted discount rate we discussed earlier.

TreeCents calculates four basic discounted financial criteria that are appropriate in different situations. These include two absolute criteria: **Net Present Value** (NPV), and **Soil Expectation Value** (SEV); as well as two relative criteria: the **Realizable Rate of Return** (RRR), and the **Equivalent Annual Income** (EAI). TreeCents calculations are made in per acre terms and reported in pre-tax and after-tax terms. If you are perverse enough to want to study the formulas, we relegated them to the BUFF appendix (Big Ugly Financial Formulas).

Two basic rules for legitimately comparisons of financial criteria are: (1) evaluating different uses of the same initial capital, over (2) the same investment horizon. If either condition does not hold, distortions are possible and comparisons need to be made with some care.

5.1 Interpreting absolute criteria

"Absolute" implies that a criterion measures the actual money value of the project in current equivalent terms. Since we are dedicating an initial asset such as land (or land plus timber) to a project, another way of interpreting NPV or SEV is "an estimate of how much this project makes my initial asset worth."

"Net Present Value" (NPV) is a decision criterion measures the present equivalent (discounted) value of all future expected net cash flows. Costs and benefits are discounted to their present equivalent using a user-specific rate of return for alternative investments. The net residual value represents the financial value of the project and can be interpreted as the value of the initial fixed capital assets that are dedicated to the project. In TreeCents, NPV is calculated for the series of four (eight in existing forests) sequential harvests. This is an implicit assumption that no costs or revenues exist beyond that point. This is a practically acceptable assumption as dim future costs and revenues (say out beyond 100 years) would be so heavily discounted the would little effect on NPV unless they are absolute enormous.

"Soil Expectation Value" (SEV) is sometimes called "land expectation value" (LEV). It is a special NPV formulation used only for evaluating timber plantation regimes that start from bare land, i.e. an assumption that land is initially unoccupied, but will be used for timber ***ad infinitum***. TreeCents allows you four harvest entries over the rotation cycle and then assumes that the cycle repeats over and over. That's why SEV should be bigger than NPV for the same project specification.

SEV is designed for valuing both "afforestation" (establishing new timber plantations from different land uses) or "reforestation" (plantations that start after clearcuts of previous timber stands). In either case, SEV assumes that timber is grown in long-run cycles that are established, harvested, and reestablished at fixed regular intervals called "rotations." SEV is easily compared to bare land use values for other regimes or other products such as annual crops or grazing.

As SEV approximates bare land value, it is really useful in cutover land purchase or sales decisions. For example, if the market price of an acre is $600/acre and your best forestry SEV is $350/acre, the acre is over-priced by your evaluation assumptions. SEV estimates are also valuable for loan collateral calculations or for tax values of bare land ***ad valorem*** property taxes.

User Tip

Positive SEV represents the production value of land per acre in this investment while still earning the guiding rate of return. The highest SEV among alternative regimes implies the value of the land in forestry allocation. Negative SEV regimes imply zero land value from this timber use—try a less intensive (less up-front cost) regime.

In comparing options, a higher SEV identifies a higher return from a management option. However, there are lots of negative SEV's in forestry. "If I win the lottery, I guess I'll keep tree-farming til its gone." That story underscores that it is really easy to specify overly-intensive timber projects with lots of high upfront costs and a long wait till distant piddly harvests. This pattern often causes negative SEV's. Excessive timber management intensity is a black hole of forestry bankruptcy—a common problem on federal forests. They can afford this kind of forestry--you can't! There are lots of forestry investments with positive SEV's that are plenty feasible. Look for: a few lower cost up-front practices that generate higher returns--sooner. This will keep your silvicultural regimes lucrative.

5.2 Interpreting relative criteria

Relative criteria are simply measures of average project performance rates over its life rather than totals at the project beginning. Rates can be in percentage terms or in units of average outcome. Relative criteria can be thought of as measures of how hard the project assets are working for you.

There are three nice advantages of relative criteria. First, they can measure the extra effects of small changes in one project's design. Second, that they can be normalized to compare unlike projects with unlike starting assets and still give reliable answers. Finally, relative criteria are really useful for capital budgeting. If budgets are limiting (and on my tree farm the term is "crippling"), use relative criteria to rank which hardest-working projects get done first in order until the money runs out. TreeCents actually has another module does this for you (described in section 8).

There is one drawback of relative criteria. Under some odd conditions, relative criteria can give different optimal project choices than absolute ones. In these cases, rely on the absolute criteria, of course presuming that your projects are correctly specified.

Realizable Rate of Return (RRR) is a relative financial indicator used to compare project feasibilities on an average percentage rate of return basis (%/year). It is a modern

formulation of the internal rate of return (IRR) without all of IRR's analytical and interpretive problems. RRR estimates the average annual rate of project earnings to its invested capital over its life. An RRR higher than the discount rate is a good project because your money is working harder in the project than in the bank. Among projects, the highest RRR indicates the best project because your money is working harder there. Negative RRR's make no mathematical sense so your report will simply show "NA".

TreeCents calculates project RRR's to the initial land use investment capital. Remember, any initial land and existing timber are also forms of invested capital. TreeCents is one of few investment programs can normalize for their initial values. The user-entered initial land, or land plus timber, current market liquidation values are used to make this work. The initial asset value is subtracted as an opportunity cost to normalize RRR's for a projects capital investment scale. Normalizing allows RRR comparability between completely different types of land use investments. It says: "The asset that I tied up plus all the extra money I invested is working this hard." If you did not enter a normalization value, your RRR will read NA (not available).

The Equivalent Annual Income criterion (EAI) makes irregular timber income easy to compare with annual agricultural net crop returns. EAI converts a net present value absolute criterion into an equivalent annual income. This treats the irregular long-cycle cash flows of the asset NPV as if they were regular annual net cash flows (so many net$/acre/year) generated by the project. Equivalent average net cash flows are easy to visualize. Projects with negative EAI's are to be avoided. The project with the highest EAI should be preferred (Klemperer, 1996). TreeCents EAI's are also adjusted by initial asset values to allow comparisons of different scale projects.

5.3 Comparing project feasibilities

There are two important interpretations in financial choices. First, is any single project financially feasible, i.e. are benefits bigger than costs in the long-run? Second, among multiple project options, which is preferable? Where is the best place to plant your hard earned cabbage. Table 1 indicates that the basic interpretations are simple to make.

Table 1: Quick Project Feasibility Criteria Indicators

Criterion	Good Project?	Best Project?
NPV, SEV	> 0	Highest
RRR	> i	Highest
EAI	> 0	Highest

For NPV and SEV, a positive value is essential for financial feasibility. That means that expected benefits are larger than expected costs. Between projects, bigger is better—holding the criterion constant, simply pick the project with the highest criterion value. **Repeated warning! Projects are only comparable using absolute criteria if they start from the same initial asset and have the same time duration.** For example, don't compare the SEV of bare ground to the NPV of an almost mature white pine stand. After all, investing more initial capital should generate more project value. That seems obvious (Duh!), but this error of comparison is one of the most common in forestry.

For RRR, a value greater than the user's discount rate signifies profitability. Less RRR than i means subpar performance. A good EAI is positive net $/acre/year. The best is the most $$. **Another warning, don't compare between unlike project with different starting assets without normalizing them.**

User Tip

In some cases, absolute criteria (such as NPV or SEV) may indicate a different preference order than a relative criterion (RRR or EAI). In these cases, absolute indicators are more reliable.

5.4 Testing results sensitivity

Good projects have positive financial criteria (or >i for RRR). An obvious concern is: "how reliable is my decision?" Most TreeCents users like to bracket their results with a range of optimistic (high) and pessimistic (low) data assumptions. TreeCents uses simple percentage bracketing rather than statistical confidence intervals, because the distribution of discrete input data variability is a guess rather than statistically valid.

Bracketing is really useful. Most non-TreeCents analysts just run a base case and just cross their fingers that reality is as good as or better than expectations. TreeCents bet-

hedging uses the pessimist results bracket. If the pessimist bracket is negative (or <i for RRR), or less than your own selection standards, watch out! Bad pessimist results suggest that the base case feasibility is less certain. You should reexamine, and potentially redesign, what could be a risky project regime. Too large bracket percentages always cause pessimist results to be negative (or RRR <i). Its more useful to use smaller bracketing.

Bracket widths compared between projects is a useful decision guide too. If two projects have the same base case results, but one has wide brackets and the other is narrow, the narrower project typically has more dependable outcomes, so is usually preferable.

TreeCents makes it really easy to test individual parameters for their effect on project feasibility. The discount rate has so much mathematical power, that it is a good idea to simulate its effects on project feasibility. Rerun a project several times changing just the discount rate. A specified project that stays positive through some discount rate variability is usually a less risky one. Likewise, you could test a single market assumption, such as the future price of timber and see if assumed changes in something we don't know much about have a big effect. TreeCents is designed for rapid decision sensitivity analyses.

6.0 DIFFERENCES FOR EXISTING TIMBER STANDS

The existing timber stands option applies when you are starting with land plus some already established tree cover. The stand doesn't have to be merchantable timber. Having immature timber generates future cash flows sooner. Existing trees contribute value to the forest acre value because they represent a more advanced stage of maturity closer to some eventual harvest date.

This type of timber investment is evaluated separately for several reasons. First, because the initial asset is different causing a different interpretation of financial criteria. Second, because the both local and federal tax treatment of existing forest assets is different from plantations. Finally, TreeCents analyzes a sequence of eight harvest entries with no automatic cycling. This allows users to specify either even-age or un-evenage harvest patterns that can be very different in every entry. TreeCents recognizes that subsequent cycles may be very different from the first, so it calculates only NPV over a user-designated horizon. Eight entries are usually more than enough to represent a long-run forestry future.

6.1 Management data organization window

Existing stands have very similar data requirements to plantations except there is no initial establishment. Establishment cost pages are missing entirely. If your project involves inter-planting sparse stands, those costs can be inserted into **Other management costs**. Once again, electing any practice that has volume responses or value responses to the additional effort suggests that you check for consistency between practices and your value and volume assumptions.

6.2 Harvest entry volume pages

There are pages for eight harvest entries as in the plantation module. As in plantations, these pages **should be completed in order**. They are tied to two conditional cash flow modules where subsequent cash flows are conditional on previous specifications. These include: a capitalized expenses analysis, and a timber cost basis depletion rate calculator. Both of these are running in the background while you are entering data. Harvest $_{n}$ effects must be calculated before harvest $_{n+1}$ can be, and so on.

On each harvest entry page, first enter the harvest year (not date, but years since investment year zero). Then enter the fixed per acre (not per MBF) costs and fixed revenues that may be associated with harvesting. If you have a large multi-acre project, allocate total project fixed cash flows to a per acre equivalent. Fixed revenues are not taxed as they are normally zero and a section 6.4 process needs a non-taxed revenue entry.

Enter the volume by value and product groups just as you did in the plantation tutorial. The last harvest entry year should be the same as the one entered in the project identification page. Volume entries are deceptively simple to make in TreeCents, but may represent some very complex silviculture. Successive growth responses in mixed even-age or uneven-age regimes can be very counter-intuitive. Growth and yield responses to different residual stocking, size class and species mixes from the first harvest make subsequent entries contingent on previous entries. For this reason, TreeCents allows complete respecification of harvest volume by value group, and product group at each entry. Forest owners using uneven-age silvicultural regimes should definitely refer to an expert or an outside source growth and yield simulator to estimate the harvest volume and stand growth interactions for you.

6.3 Land cost and timber cost basis page

This page is very different from the plantation module (figure 20). There are two important new entries that are unique to existing stand investments. These relate to the original cost basis of the stand for calculating capital gains taxes.

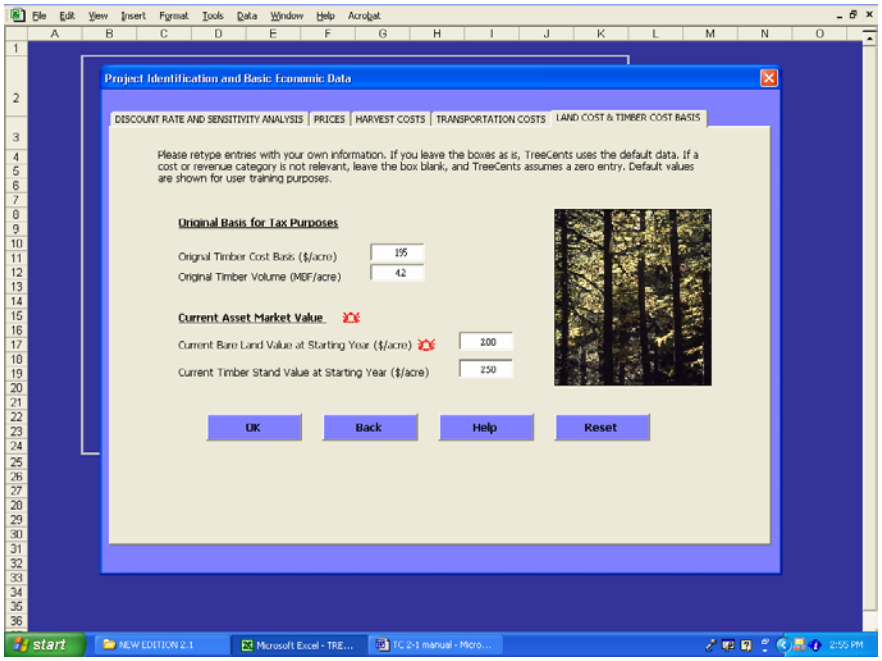
Project Identification and Basic Economic Data
DISCOUNT RATE AND SENSITIVITY ANALYSIS
PRICES
HARVEST COSTS
TRANSPORTATION COSTS
LAND COST & TIMBER COST BASIS
Please retype entries with your own information. If you leave the boxes as is, TreeCents uses the default data. If a cost or revenue category is not relevant, leave the box blank, and TreeCents assumes a zero entry. Default values are shown for user training purposes.
Original Basis for Tax Purposes
Original Timber Cost Basis ($/acre)
195
Original Timber Volume (MBF/acre)
42
Current Asset Market Value
Current Bare Land Value at Starting Year ($/acre)
200
Current Timber Stand Value at Starting Year ($/acre)
250
OK
Back
Help
Reset

Figure 20: Land cost and timber cost basis page

6.3.1 Depletion accounts

In the "original basis for tax purposes" enter the timber account allocation value of your original land plus timber purchase cost. When you bought this parcel, you allocated some of the parcel cost to timber, some to land and some to improvements. If you started this stand as a plantation, your entry should be zero. TreeCents uses basis cost and original cruised purchase volume to calculate a proportional depletion rate. The depletion rate becomes a volume-sensitive tax deduction from future timber sale gross revenues harvest after harvest until the original timber cost basis is used up. There is a basis report button imbedded in the harvest entry pages, so you can see the basis distribution.

6.3.2 Current asset market value

This is an estimate of the land plus timber current market liquidation value sold as a whole parcel (not harvested). This value is a rough estimate of the financial value of the forest physical capital (land and immature stand) that becomes tied up in this project design. Initial capital value does not affect calculations of absolute criteria, but is subtracted as a cost (i.e. you could have sold it and didn't) in relative ones. This recalibrates relative criteria so they will estimate return rates to the base asset capital.

6.4 NPV calculation assumptions

Existing stand calculations vary in another important way from the plantation module. You are allowed eight harvests that **do not repeat** as an infinite cycle of identical regimes. The reason for this format is to recognize the potential for extreme harvest variability that happens in mixed even-age and uneven-age regimes.

Unfortunately, it does introduce some problems. First, NPV's are only technically comparable if the initial project assets are the same alternative treatments are valued over the same time horizon. If you spread one regime's eight harvests over forty years and the others over 100, you introduce time biases into the evaluation criteria. The easiest solution is to design regimes over the same duration. For example, you could compare five 30-year spaced entries to three 50-year spaced entries. This would eliminate time difference bias.

Second, if the last harvest is a partial cut and leaves substantial volume for an unmeasured ninth entry, project NPV will be slightly understated because it ignores the intentional build-up of stand capital in the silvicultural design. Usually this effect is so far into the future that it is small. However, it can easily be corrected for by a mental slight of hand. Just assume that the last harvest **is** a clearcut, whether or not it really is. This artificially combines the cash value of an actual harvests, with the opportunity value of the residual stand you're retaining. In this manner, regimes that build up forest capital are logically comparable with regimes that deplete it. This is a form of "green" accounting.

6.5 Conversion harvest calculations

There are times that users may want to treat the initial timber stand as an interim stage of management. You manage the existing stand volume and structure or advanced

regeneration to maturity. Then you convert the acre to even-age plantation of a more appropriate species mix. Many inland western private forests are doing this with natural grand fir stands—eventually replacing it with the historically and ecologically more appropriate (and it doesn't hurt that it is more valuable) monocultural and even-aged ponderosa pine or western white pine stands.

Most investment simulators won't handle this midstream management style switch. However, in TreeCents there is an easy, although not obvious, adaptation. First, run the expected future plantation. Record the SEV and set it aside. Then run the existing timber stand analysis. Clearcut all the volume in the entry harvest page that represents the end of your management of the existing stand. Leave the other harvest pages blank. In that existing stand harvest year (h) of the last clearcut, add in the SEV value of the intended replacement plantation from the plantation run. It goes into the fixed harvest revenue slot of year h. This says to TreeCents: "In year h, I got both: (1) the clearcut final harvest revenues, along with (2) the year h equivalent of starting a subsequent use of the bare land as a plantation. TreeCents does the necessary SEV entry inflation for you.

7.0 NONTIMBER INVESTMENT ALTERNATIVES

Rural land can produce more than trees. In most landscapes, economists can predict the zones where the crops, forests and pastures will occur. Picking the optimal land use depends on a combination of relative soil productivity for different uses and the effect of location on production costs, hauling costs and delivered crop values. At the intersections of these zones, the optimal land use may hinge on small differences. TreeCents can help you evaluate whether land use changes are financially desirable using the same criteria we used to evaluate timber projects.

Start TreeCents as usual. At the land use choice window, this time select **Alternative Land Uses** . In the next window (figure 21) select between **Crop Land Uses** and **Pasture Land Uses** . It's a simple choice between cultivation and grazing.

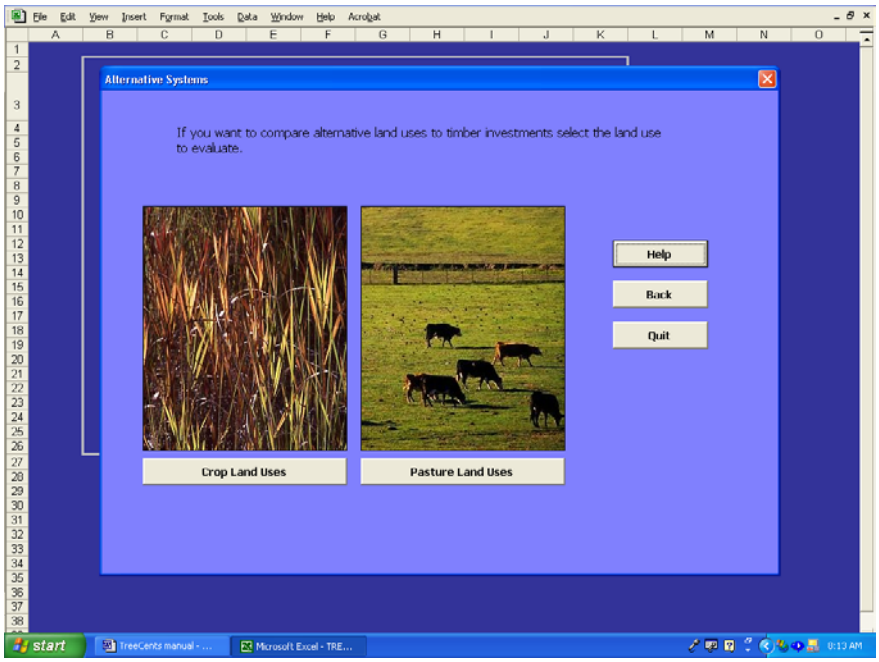
Alternative Systems
If you want to compare alternative land uses to timber investments select the land use to evaluate.
Help
Back
Quit
Crop Land Uses
Pasture Land Uses

Figure 21: Alternative land use choice window

7.1 General alternative land use analyses

The remaining windows in both analyses are designed to function like the timber windows. There are only a few small differences. The most important is that TreeCents analyses of other land uses are designed as illustrative rather than exhaustive project analyses. There are analytical shortcuts and the data resolution is lower. If you want more detailed crop and pasture analyses, most state agricultural experiment stations publish crop budgets and dedicated agricultural project financial simulators.

In both the alternative land use analyses, the first step is to choose whether to make a **New Data Set** or use **Existing Data Set** in the same way we made timber project data sets. Choose **New Data Set** for this tutorial.

7.2 Agricultural land uses

Agricultural uses imply cultivation of annual crops. TreeCents asks you to define a three-year crop cycle that repeats forever. You may specify repetitive identical annual crops or any three-year cropping pattern including rest/rotation cycles. The first window (figure 22) pulls together a lot of the project definition labels and general data that was spread to multiple screens in the timber projects. The project initialization window is

mostly labeling and setup data. Notice that tax parameters are fewer as crops face only ordinary income taxes and bare land property taxes.

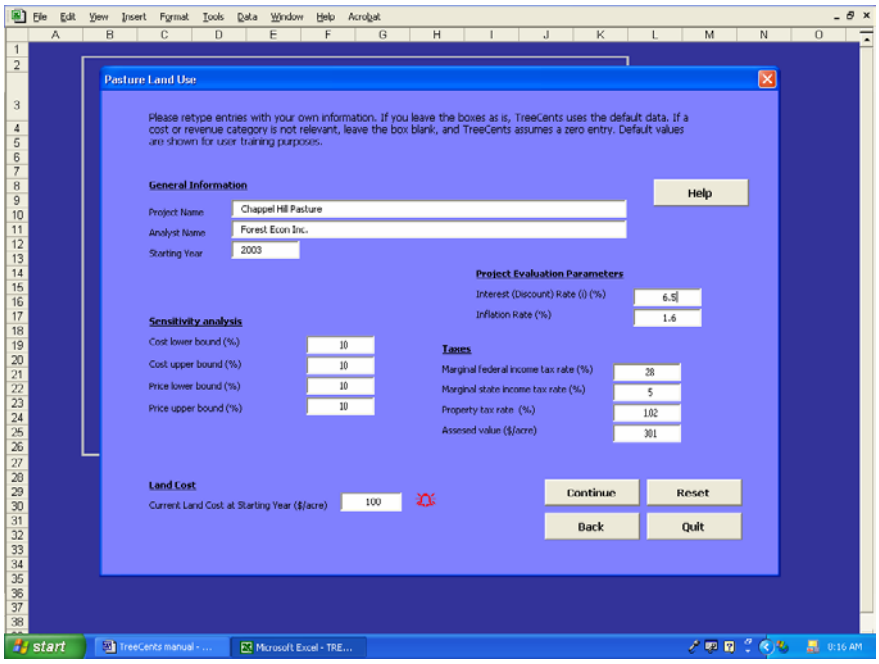

Figure 22: Agricultural crop initialization window

Continue takes you to the multiple crop data organization window. Write a crop type label next to each year in the 3-year crop cycle. The default shown is based on an actual winter wheat-feed barley-dry pea cycle that is common in eastern Washington. All TreeCents editions have this same default case example. Make one of your own to represent your region.

Simply clicking on a crop label takes you to that crop's project data. For each crop you list, you find one page of expected yields and revenues and four pages of cost categories including: preharvest, administration, harvesting, and other costs. When you finish one crop, **Continue** to cycle back. Select and finish the pages for remaining crops.

- Crop annual acreage yields, and per unit values are entered right after clicking on one of the three crops you just labeled.
- Pre-harvesting costs include activities such as site preparation, cultivation, sowing, seeds, among others, in dollars per acre. The default assumes rented machinery costs.

- Harvest costs can be lumped or segregated in $/acre. Coordinate harvest costs with yields.
- Administration costs include management fees, interest in operational costs, crop and property insurance, and general overhead. General overhead covers all unallocated costs such as legal and accounting fees, utilities, etc.
- Other costs introduces any extra cost not previously listed. Do not enter land rental costs as you are calculating land value and liquidation value for normalization was entered on the initialization window.

User Tip

If crops are identical year-to-year (e.g. haying) make sure all three screens are entered identically.

Once all the pages are completed for all crops, **Continue** takes you to the same report choices that you had for timber projects. Now that you have entered an alternative land use project, the comparative project report has meaning and can demonstrate returns for different uses side-by-side.

7.3 Pasture land uses

Pasture uses assume that a land owner is growing grass and selling grazing rights. Grazing rights are sold in Animal Unit Months (AUM) per acre. That is the amount of forage that can be consumed by an 800 pound cow and calf or the equivalent in sheep or other animal grazing. TreeCents pasture calculations are similar in format to agricultural crops but simpler. Pasture production is assumed to be annual, not cyclic. There is no rest rotation mechanism. The grazing AUM production is assumed to be simultaneous in parts of each year by the animal types that you list.

The project initialization window is mostly labeling and setup data. Notice that tax parameters are fewer as crops face only ordinary income taxes and bare land property taxes. Then there is one set of five AUM revenue and management cost pages. These include:

- Animal capacity and revenue page allows you to enter up to three animal types that may use the same pasture over a grazing season. Units are in months of use so the sum should be less than the grazing season length. As western grazing capacity is often measured in acres per AUM rather than AUM's per acre, allocate total pasture use rates to a single acre equivalent. Eastern AUM figures tend to be significantly higher. Revenue prices should be in gross pre-tax terms.
- Pasture preparation costs include any practices for annual pasture grass establishment as well as maintenance of perennials.
- Administration costs include management fees, interest in operational costs, crop and property insurance, and general overhead. General overhead covers all unallocated costs such as legal and accounting fees, utilities, etc.
- Animal control costs include the land owner's costs of maintaining herd control and separation. The lease holders costs should not be included
- Other costs introduces any extra cost not previously listed. Do not enter land rental costs as you are calculating land value and liquidation value for normalization was entered on the initialization window.

7.4 Comparing alternative land use results

Alternative land use results are easy because they always start with bare land (unless some initial conversion such as clearing occurs). This makes their SEV's directly comparable with timber SEV's. If you are evaluating project different uses of the exact same acre they will have the same initial market asset liquidation estimate so all relative criteria are immediately comparable and the biggest is best.

The problem comes in comparisons with existing timber asset criteria. The same caveats discussed in timber comparisons apply. Investing land plus existing stand is dedicating more initial asset capital stock to a project so there will be a scale distortion. This distortion was discussed in detail in section five.

8.0 COMPARE PROJECTS RANKING MODULE

On one of the earliest path branches led to a project comparisons module that our tutorial passed by. This simple routine makes comparing project variants or investment choices easy and visual once you have all the results. This module is intended to make capital budget project ranking easier. However, remember that TreeCents works in per acre terms. You will actually want to do all the acres of a higher ranked project with your available budget before moving on to lower ranked investment opportunities.

Your first window (figure 23) asks you to define the comparison criterion. This is a labeling function only. The default uses after-tax RRR because that tends to be the most useful ranking criterion. Then from your previous runs, enter your various project labels in the list with the RRR after-tax results that you got by that criterion. You have the option to list only the base case results or all of you pessimist, base, and optimist findings. Press the rank button and TreeCents ranks the base case RRR of all the projects and takes you to a tabular report that can be printed with a button.

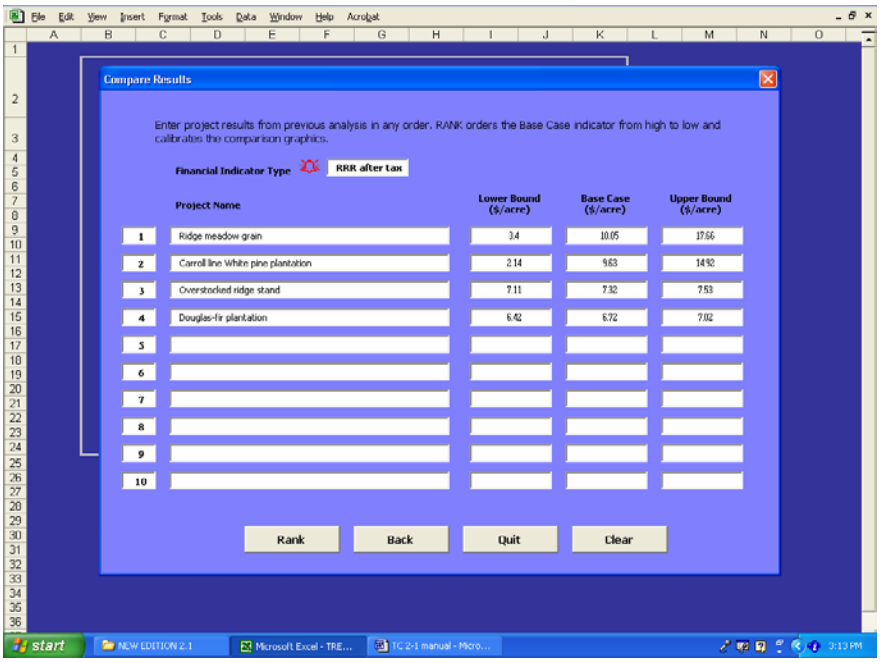

Figure 23: Comparative projects window

The more interesting feature is to graph the ranked projects. In the tabular comparisons report press **Plot Results.** That automatically calls graphical ranking and

generates a formatted ranked projects graph (figure 23). Although ranking is for the base case, this graph presents a visual comparison of project brackets as well. In the default example case, projects #3 and #4 have only slightly smaller RRR's but very tight (i.e. confident brackets). Many forest owners would choose a certain good return over a highly risky one that was only slightly better.

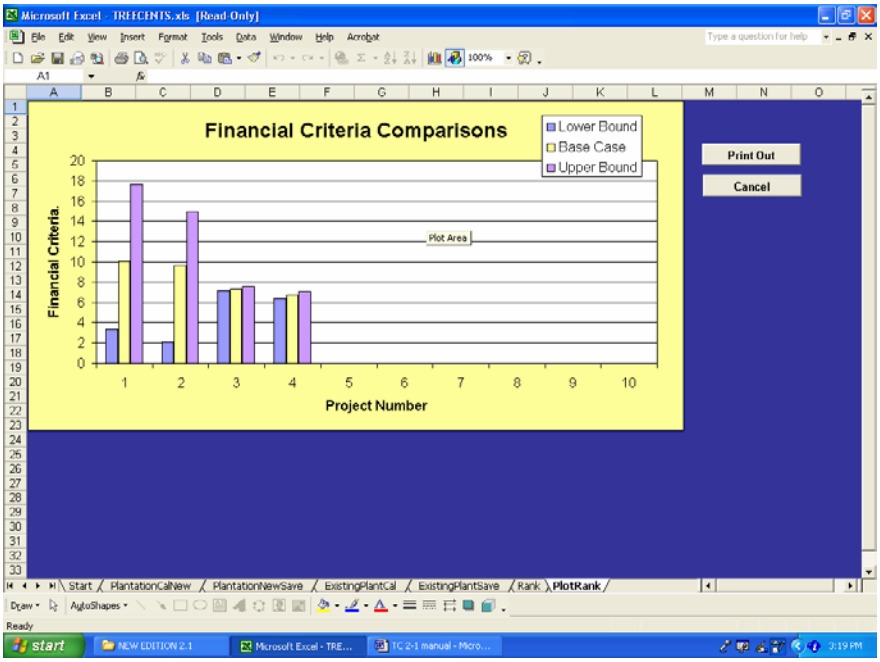

Figure 24: Ranked projects graph

9.0 LIMITATIONS

We created TreeCents to help individual landowners to make better financial decisions. Timber-oriented private tree farmers are increasingly being joined by others who own rural forests for residential, recreational, conservation or tax purposes. Non-timber forest owners also manage forests and treat timber harvests as a by-product. TreeCents usually demonstrates that many different objectives are complementary with well-chosen timber regimes. For example, commercial thinning can be designed to augment a wide variety of wildlife habitats while generating timber income too. TreeCents should improve timber-based financial decisions for most of these ownership groups.

The simulator does, however, have some specific limitations. A major one is that it requires supplemental data from external sources that may be unfamiliar to land owners.

This includes market and costs data as well as timber yield projections that are project specific. In both cases, TreeCents offers only a limited set of example default data. In the future, this information gap should close as land grant universities and others conduct more research and extension services make such information more readily available. For now, TreeCents provides an information wish list format that will help forest owners identify their information needs and improve communication with the consulting foresters that they'll work with. In the mean time, remember, that TreeCents will run fine with less precise data estimates and give you good approximations of the most valuable regimes—and you can always do quick sensitivity analyses to check your presumptions.

10.0 RECOMMENDATIONS TO USERS

We can sum up this program and manual in a few words. "TreeCents works!" It is more than just a pretty software platform. It is easy to use, flexible enough to represent lots of timber investments, and it calculates accurate, reliable, and easy-to-interpret decision assist criteria. As you use TreeCents it is worth keeping in mind the following:

- The default data is an example only. Don't rely on default findings except for training yourself about decision logic, familiarity with TreeCents, and a format for your own data inputs.
- Represent your own case with your own data, but don't get carried away. Many small details (high resolution) may increase TreeCents' apparent precision without affecting the real accuracy of a project decision.
- Practice makes easy! Your first run is exploratory. Self-training and repetition leads to significant increases in analytical speed and ease of use.
- Think in relative terms. TreeCents calculates absolute estimates of various criteria, but they may not be perfectly accurate. For example, TreeCents tree farmer behavioral assumptions (particularly about how cleverly you handle your taxes) may not always hold. However, relative outcomes still generate valuable insights about "best" choices.
- Of course you are hunting specific project financial returns, but also use TreeCents to teach you what makes various project designs turn out as winners or turkeys.

- Run a number of project variants to fine tune regimes. Use TreeCents' save, button jump and small changes options to cut through the tedium of repetitive analyses.
- You can't know the future perfectly! Make use of TreeCents' bet-hedging capabilities. Use a realistic pessimist/optimist bracket for each project. Then make multiple runs to test various regimes under a range of variable assumptions and practices to check sensitivity to assumptions and specifications.
- Apply a rule of rationality. Do the results make sense as well as cents? Odd results may suggest a data entry error (or heaven forbid—a program error). If you're not sure, check your inferences and suspicions with an extension agent, consulting forester or financial specialist before dedicating big bucks to a project.
- TreeCents already makes useful data and report file on each project variant. Use them to organize data, represent prescriptions in long-range management plans, and send them back and forth to your consulting forester as a communications medium.

11.0 LIMITED LIABILITY

We developed TreeCents as a decision support system to help land owners understand, plan and evaluate timber investments. Forest Econ Inc. made every effort in design and field testing to assure accurate program function within the disclosed set of analytical premises. Neither the program authors nor Forest Econ Inc. can be responsible for the success of inherently risky timber investments. In the end, assuring timber project profitability is the job of the owner. We hope that TreeCents has helped you make accomplishing that job quicker, cheaper and easier.

12.0 CONTACTING THE AUTHORS

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We think we caught all the TreeCents program bugs from previous versions, but we are continually upgrading it. If you encounter anything that appears to be an analytical or process program bug; if you have suggestions for simplifying or clarifying the process logic or user manual text; or if you have data suggestions that could improve the default data set, please contact us.

APPENDIX BUFF

Big Ugly Financial Formulas

There is a reason that we hid these formulas from you—they can be scary. We'll start with the simple one--NPV. It is just the sum of costs discounted from their time of occurrence subtracted from the sum of discounted benefits. This is the classic formula. We've left out all the intertemporal adjustments and contingent cash flows that really complicate the forestry applications formulas

$$NPV = \sum_{t=0}^{n} \frac{B_t}{(1+i)^t} - \sum_{t=0}^{n} \frac{C_t}{(1+i)^t} + \frac{b-c}{i}$$

Where:

NPV	= Net Present Value ($/acre)
C	= Costs incurred in period t ($/acre)
B	= Benefits realized in period t ($/acre)
c	= costs incurred annually ($/acre/year)
b	= benefits realized annually ($/acre/year)
t	= Year costs incurred or benefits realized
i	= Discount (interest) rate

SEV (Soil Expectation Value) is calculated by an ingenious formula first thought up by an obscure Austrian forester, Martin Faustmann, in 1849. Although used by Europeans since then, it was not discovered by Americans (actually Ralph Marquis) until the early 1950's. It is specified as:

$$SEV = \frac{-\sum_{t=0}^{R} C_t (1+i)^{R-t} + \sum_{t=0}^{R} B_t (1+i)^{R-t}}{(1+i)^R - 1} + \frac{b-c}{i}$$

Where:

SEV	= Soil Expectation Value ($/acre)
C	= Costs incurred in period t ($/acre)
B	= Benefits realized in period t ($/acre)
c	= costs incurred annually ($/acre/year)
b	= benefits realized annually ($/acre/year)
R	= Cycle length or Rotation age (years)
t	= Year costs incurred or benefits realized
i	= Discount (interest) rate

Whew! Aren't you glad to avoid this mess by using TreeCents? Remember, TreeCents actually does more complex formulations that allow for many more cash flow patterns, conditional cash flows such as taxes, as well as costs and values that change over time with inflation and market shifts.

The Realizable Rate of Return (RRR) is calculated as the project duration root of a ratio between the future equivalent sum of benefits to the present equivalent sum of costs. This modern formulation of the Internal Rate of Return (IRR) does not have the latter's math foibles nor interpretation glitches. It is generally computed as follows:

$$RRR = \sqrt[n]{\frac{\sum_{t=0}^{n} B_t (1+i)^{R-t}}{\sum_{t=0}^{n} C_t /(1+i)^{R-t}}} - 1$$

where:

RRR	= Realizable Rate of Return
i	= Assumed reinvestment rate
R	= Project life
B_t	= Revenues gained in year t
C_t	= Costs incurred in year t

The Equivalent Annual Income (EAI) looks like the simplest formula, but remember that it is a normalization adjustment of the sometimes hairy NPV. It is calculated as:

$$EAI = NPV * i$$

where:

EAI	= Equivalent Annual Income
NPV	= Net Present Value
i	= Discount rate

TreeCents artificially normalizes both the RRR and EAI further to recognize returns to initial project capital when users supply initial asset liquidation values. TreeCents subtracts these as a year zero cost prior to RRR and EAI computation.

TreeCents Data Sources and User-Supplied Data

Nora Creek Forest, 2003, Log merchandising costs and distribution patterns, personal communication.

Northwest Management, Inc. 2003. Current delivered log prices in Inland Northwest Market Report, <nwmanage@consulting-foresters.com>

Seven Ridges Forestry 2003, Inland west typical timber management regimes, personal communication, <ID4ster@yahoo.com>

Smathers RL 1999a. Feed barley. 1999 North Idaho crop costs and returns estimate. University of Idaho, College of Agriculture, EBB1-FB-99.

Smathers RL. 1999b. Soft white winter wheat. 1999 North Idaho crop costs and returns estimate. University of Idaho, College of Agriculture, EBB1-SWW-99.

Smathers RL. 1999c. Spring peas. 1999 North Idaho crop costs and returns estimate. University of Idaho, College of Agriculture, EBB1-SP-99.

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Davis LW, Johnson KN, Bettinger PS, Howard TE. 2000. Forest management: to sustain ecological, economic and social values. New York, NY: McGraw Hill Book Company. 804 p.

Helms JA. Editor. 1998. The dictionary of forestry. Bethesda, MD: The Society of American Foresters. 210 p.

Klemperer WD. 1996. Forest resource economics and finance. New York, NY: McGraw Hill Book Company. 551 p.

Rideout DB, Hessein H. 1997. Principles of forest and environmental economics (Revised edition). Fort Collins, CO: Resource and Environment Management.

Smith DM, Larson BC, Kelty MJ, Ashton PM. 1997. The practice of silviculture: Applied forest ecology. New York, NY: John Wiley and Sons Inc. 537 p.

TreeCents Definitions

Administration costs: are costs that occur over a year covering office expenses, legal and accounting fees, and utilities (Smathers, 1999a).

Ad valorem property tax: an annual tax payment levied as a percentage of the assessed property value (Klemperer, 1996).

Aerial spray: application of chemical products from the air by airplane or helicopter.

Animal control: costs to counter possible attacks of animals on the plantation or crops.

Annual costs: any costs (e.g. taxes, administration, protection and others) that occur at the same level every year as long as the plantation exists (Heilman et al., 1995).

Assessed value: is a taxable asset value to which an annual ad valorem property tax rate is applied. It may be assessed locally as a market value, or may be a fixed special use assessment (Klemperer, 1996).

Base case: the "best guess" at the most probable assumed regime conditions that you expect for a particular regime over its life.

Capital gain: the difference between the sale price and the purchase cost of an asset held longer than one year (Klemperer, 1996).

Carbon dioxide fixed: the quantity of carbon dioxide fixed (tons) on one acre of forested land over a rotation cycle.

Commercial thinning: a thinning where felled trees are extracted for useful products regardless of whether the revenues obtained for these products pay off the operational costs (Smith et al 1997).

Crop insurance: insurance purchased to protect the crop returns against unexpected events.

Cultivation: mechanical soil disturbance for sowing or a weed control technique without using chemical products.

Discount rate: alternative earnings rate of capital, expressed as an annual percentage rate. TreeCents uses it as a discount rate to convert a future cash flow to its present value equivalent (Klemplerer, 1996).

Equivalent annual income: converts the Net Present Value into an annuity of net cash flows to be compared with annual agricultural crop returns.

Extracted volume: the total volume removed when a thinning is done.

Fertilization: the addition of nutrient elements to the soil to improve growth increments or overcome nutrient deficiencies (Helms, 1998).

General overhead: an annual cost that covers office expenses, legal and accounting fees, and utilities (Smathers, 1999a).

Ground spray: application of chemical products from the ground.

Harvest: final cutting where crop trees are extracted (Helms, 1998).

Herbicide application: chemical product used to kill or control the growth of undesired plants (Helms, 1998).

Labor: includes human hand labor and machinery operating labor used for production activities.

Lower bound: in sensitivity analysis, the lower bound identifies a pessimistic scenario. It includes higher costs and lower prices to replicate the worst investment situation that you might reasonably expect.

Machine rental: is a payment for machine use charged in the year that the machine is employed.

Management cost: management is a specific activity, measure or treatment practice in a forest stand (Helms, 1998). Management costs include all costs incurred to execute those activities.

Management fee: the costs of annual supervision and planning (Heilman et al. 1995).

Marginal federal income tax rate: a tax rate paid to the federal government for all the ordinary incomes from an additional investment (Klemperer, 1996). Taxable poplar plantation income is treated as an income that supplements existing ordinary income from other sources.

Marginal state income tax rate: a tax rate paid to the state on all ordinary incomes. State taxes are deducted from gross incomes before federal income taxes are calculated (Klemperer, 1996).

Other costs: costs not included in existing cost categories that are relevant to the investment analysis.

Planting: all the activities related to sowing crops in seeded agriculture or vegetatively establishing tree crops.

Planting costs: includes all the costs incurred in planting practices such as cuttings, plant, fertilization, and herbicide applications.

Planting subsidy: money from an outside source for doing carbon credit sequestration paid on the plantation date.

Precommercial thinning: reducing the stand density (number of trees per acre) for reasons of forest health, product quality or habitat structure without sale of the removed cellulose.

Property insurance: insurance purchased to protect the property or project income against unexpected events.

Pre-plantation costs: costs related to all the practices that occur before planting cuttings.

Pruning: the removal of live or dead branches or multiple stems from a standing tree with the purpose of improving the tree form or its timber quality (Helms, 1998).

Pulpwood: roundwood logs sold for fiber that will be used in the manufacture of paper and allied products.

Realizable rate of return (RRR): a relative financial indicator used to compare projects on an annual rate of return basis (Davis et al., 2000). RRR is a modern formulation of the internal rate of return.

Remnant trees: standing trees left over after thinning.

Rotation age: the tree stand cycle length (in years). It is the total time between the plantation establishment and the final harvest (Helms, 1998).

Sawlog: a log that will be sawn into lumber meeting minimum regional standards of diameter, length and defect (Helms, 1998).

Sensitivity analysis: process to measure how investment analysis results are affected by changing assumptions such as costs, prices, revenues, discount rate or volumes. When the investment decision changes significantly with a change in a particular assumption, it is considered "sensitive" to that assumption (Klemplerer, 1996).

Severence tax rate: a harvest tax levied as a fixed payment amount per harvest volume unit. Severence taxes are distinguished from “yield” % taxes on gross harvest revenue. Unfortunately, in their legislative wisdom, both Washington and Oregon call their yield taxes “severance” taxes.

Site preparation: is manipulation of the land to achieve the best physical soil conditions to enhance plantation establishment success (Helms, 1998).

Soil expectation value (SEV): soil expectation value (also called land expectation value) is an absolute financial criterion based on the net present value of expected cash flows from infinite number of plantation cycles. The highest soil expectation value regime establishes the maximum value that a buyer could pay for land and gains the guiding rate of return (Helms, 1998).

Thinning: a cultural treatment that reduces stand density to improve the growth of the remnant trees (Helms, 1998).

Transportation cost rate: the per unit cost of hauling one unit (MBF or green tons) of already loaded logs for the distance of one mile.

Upper bound: in sensitivity analysis, the upper bound identifies an optimistic scenario. It includes higher prices and lower costs to replicate the best investment conditions that you might reasonably expect.

Value per ton fixed: the carbon sequestration payment for each ton of atmospheric carbon dioxide fixed by a plantation over its rotation cycle.

Yield data: tree volume tables that predict the total wood volume harvestable per tree at different ages.

Yield tax rate: is a harvest tax levied as a percentage of gross stumpage value (Klemperer, 1996). The % of gross revenue tax distinguishes "yield" taxes from fixed amounts per unit volume "severance" taxes. Unfortunately, in their legislative wisdom, both Washington and Oregon called their yield taxes "severance" taxes.